MOVE AZ
Long Range Transportation Plan

MoveAZ Plan

prepared for

Arizona Department of Transportation

prepared by

Cambridge Systematics, Inc.

In association with

Lima & Associates

September 2004

ADOT

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Table of Contents

Table of Contents
(continued)

List of Tables

List of Tables
(continued)

List of Tables
(continued)

List of Figures

List of Figures
(continued)

1. Guiding Principles – Strategic Direction

Chapter 1. Guiding Principles – Strategic Direction

The Arizona Long-Range Transportation Plan (MoveAZ) provides planning guidance for the Arizona Department of Transportation (ADOT) for 20 years. MoveAZ is one of several planning activities conducted by ADOT and fits within a larger set of activities used by the agency to identify transportation needs, develop solutions, and deliver specific projects to address these solutions. The plan has three main goals:

1. To provide a **strategic direction** for transportation planning in the State;

2. To conduct in-depth analysis of actual projects and programs using **performance-based planning** techniques; and

3. To **coordinate** with regional planning agencies and the general public throughout the planning process.

MoveAZ helps ADOT address the many transportation challenges that Arizona will face over the next 20 years. The plan provides ADOT with tools to help evaluate and prioritize solutions to these challenges.

1.1 Why Develop a Strategic Direction

The strategic direction is the foundation for the MoveAZ Plan, providing a base on which all elements of the plan are built. It includes a process to understand transportation issues in Arizona, as well as the larger context in which the transportation system must operate. It is linked to all stages of the planning process and connected to previous planning efforts conducted by ADOT, as well as by other state, regional, and local agencies.

The elements of the strategic direction include a mission statement and long-range goals and objectives. The mission statement is a general, brief description of the desired future for transportation in Arizona. The long-range goals provide additional specificity, defining several goals for ADOT to focus on in the development of MoveAZ. The objectives are statements that describe the specific means to achieve these goals.

In addition to identifying a desired future for transportation in the State, the strategic direction guides the evaluation of projects and programs. The MoveAZ Plan is performance-based, providing ADOT with several tools to understand the use of the transportation system and the impact that specific projects will have upon that system.

The strategic direction process included grouping the long-range objectives into broad performance factors. These factors – one-word descriptions such as mobility, safety, and others – capture the spirit of one or more of the objectives. The performance factors provide the basis for developing performance measures used to conduct specific project evaluations. The long-range objectives also inform the selection of performance measures. Performance-based planning and the selection of performance measures are described in Chapter 4.

1.2 How the Strategic Direction Was Developed

The MoveAZ Plan has not been developed in a vacuum. Instead, it has been integrated with previous planning efforts conducted both by ADOT and other agencies in the State. The strategic direction provides one clear link between previous planning and MoveAZ.

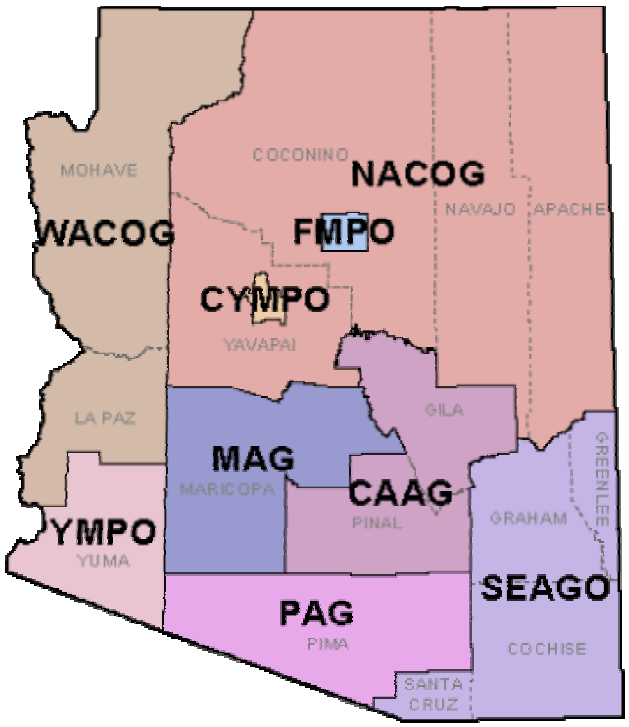
The strategic direction is based on a review and evaluation of previous planning processes in Arizona and similar experiences from other states. ADOT identified recurrent themes and issues from these sources and, through review with internal and external advisory bodies and the general public, developed a mission statement and long-range goals and objectives that constitute the strategic direction.

The first step in developing the strategic direction involved reviewing the following major planning efforts:

- Transportation and vision-based plans conducted by ADOT and regional and local transportation entities in Arizona;
- Planning documents and policy analyses conducted by state agencies and research institutes with mandates other than transportation, such as economic development, land use, and commerce;
- Similar transportation planning activities in Southwestern and Rocky Mountain states, as well as in states that have pioneered vision-based planning efforts; and
- Four papers commissioned for the MoveAZ Plan that examined specific issues relevant to the future of transportation in Arizona.

The second step in the development of the strategic direction was a review of this material by ADOT and the Working Group, an advisory committee convened for the MoveAZ development process. The Working Group consisted of the chief executives and head transportation planner for each of the regional planning agencies in the State (Figure 1.1), as well as a representative of the Arizona Transit Association (AZTA) and the Inter-Tribal Council of Arizona (ICTA). The Central Yavapai Metropolitan Planning Organization was formed in December 2003 and joined the Working Group at that time. This group was consulted throughout the planning process and reviewed all key documents produced for the plan, including the strategic direction.

Figure 1.1 Regional Planning Agencies in Arizona



The final step in the development of the strategic direction was public review of the assembled material and draft strategic direction. Chapter 2 describes the public partnering process used by MoveAZ.

The material produced for review by the Working Group and the public covered two subjects: 1) the key transportation issues to be addressed in a long-range plan, and 2) the general issues and trends that shape the overall environment within which the transportation system operates. The remainder of this section provides a summary review of these subjects. Appendix A contains a more comprehensive review of previous planning efforts.

Summary Review of Transportation Plans

One source of the strategic direction was previous planning efforts, including plans developed by ADOT, the Governor's Office (notably the Transportation Vision 21 Task Force), metropolitan planning organizations, councils of governments, and American-Indian reservations. These plans provided raw material that was shaped into the mission statement, goals, and objectives.

MoveAZ included a review of over 100 plans that revealed several important factors that must be part of the strategic direction for Arizona. Table 1.1 presents a summary of the

elements raised in previous planning efforts by the type of agency that produced the plan (ADOT statewide and corridor plans, ADOT small area transportation plans, regional plans, tribal plans, and other plans). For each cell of the table, a mark indicates how frequently plans of a given type mentioned particular transportation issues or concerns, such as mobility, safety, and funding.

Table 1.1 Elements of Past Strategic Direction Efforts

Element	ADOT	Small Area	MPO	Tribal	Other
General Elements					
Balanced/multimodal	◆	◆	◆		◆
Transportation Elements					
Accessibility, mobility		◆	■	◆	■
Safety		■	◆	◆	
Funding flexibility, local control					■
Stable, equitable funding	◆	◆		■	■
Connection to Other Factors					
Land use connection	◆	◆	■	■	◆
Environmental	◆	■	◆	√	■
Economic development	◆	√		√	
Tourism, recreation		◆		◆	
Social issues				√	
Community character		■		◆	■

■ – A few mentions; ◆ – Several mentions; and √ – All or nearly all plans mention.

Source: Cambridge Systematics, 2002.

Plans from most levels of government encouraged the development of a balanced, well-integrated multimodal transportation system. The features of this system clearly included connections to land use, environmental planning, and economic planning. Additionally, past efforts make note of the need to provide a safe, accessible system that ensures easy mobility in both urban and rural areas. Rural areas often have different needs than urban areas, and the MoveAZ Plan is sensitive to these differences. American-Indian reservation plans, in particular, tended to raise somewhat different, though overlapping, concerns than other plans.

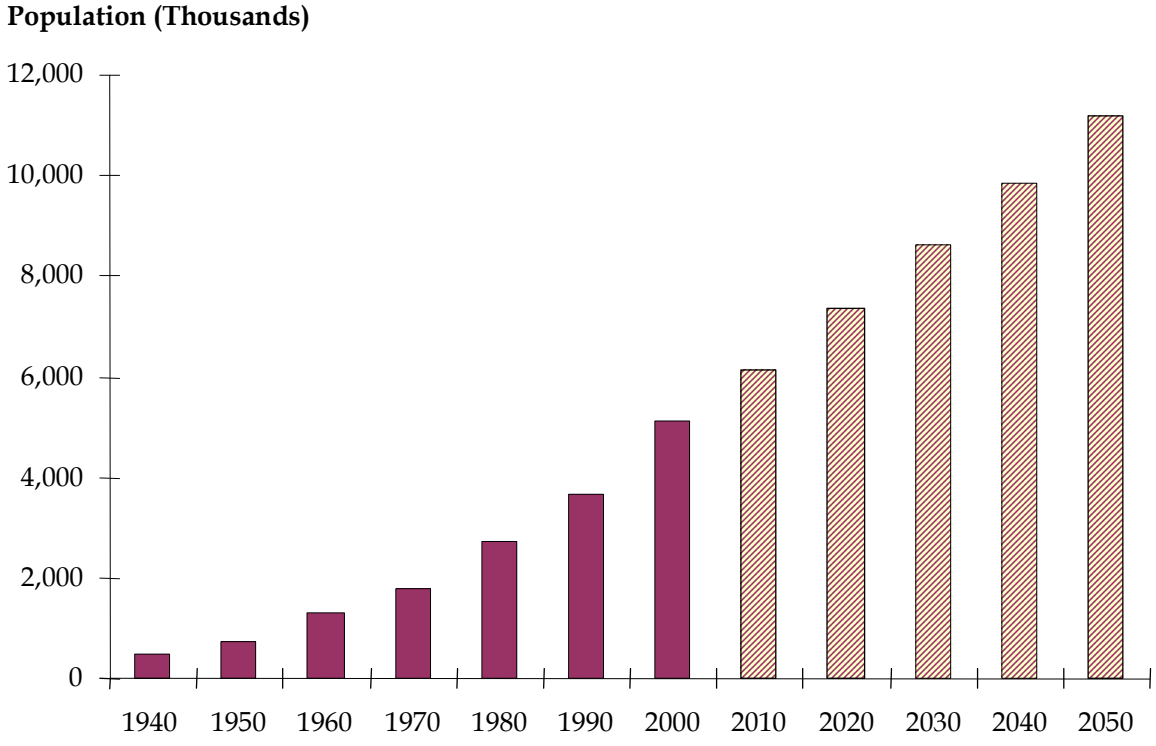
The Arizona Context

In addition to reviewing past transportation and other planning efforts in Arizona and other key states, the MoveAZ strategic direction drew from an assessment of major trends and issues facing the State, including population growth and change, economic change, environmental issues, quality of life, and urban-rural differences in Arizona.

Population Growth and Change

Arizona has been among the fastest growing states in the U.S. every decade since the 1960s. The State has grown from only 250,000 people in 1950 to over five million in 2000. The Phoenix region has added over two million new residents since 1970, and is currently home to nearly three million people. Population projections developed by the Arizona Department of Economic Security show Arizona adding another 2.5 million people by 2020 (Figure 1.2). Future population growth will continue to be centered in Phoenix, but the number of metropolitan areas in Arizona is growing. With the Prescott area recently certified as the Central Yavapai Metropolitan Area, continued growth in Yuma and Flagstaff, and several other areas likely to achieve metropolitan status by 2025, Arizona will face a host of new and emerging transportation needs and concerns.

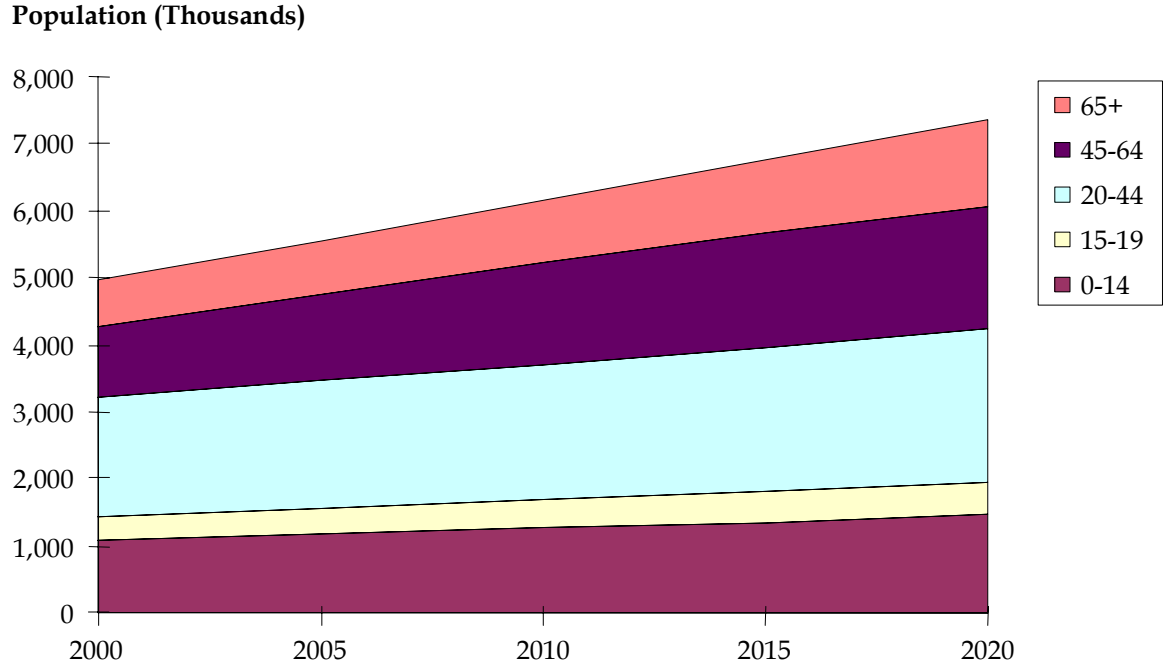
Figure 1.2 Historic Population Growth and Future Estimates



Source: Arizona Department of Economic Security, 2002.

The composition of Arizona's population is changing as well. Like many states in the southwest, Arizona is a major destination for Mexican and other Latin American immigrants. On average, these immigrants have somewhat less education, are younger, and have larger average household sizes than Arizona's historical population base. In addition, Arizona's population has been aging, a trend that is expected to continue in the future (Figure 1.3).

Figure 1.3 Projected Age Distribution of Arizona's Population



Source: Arizona Department of Economic Security, 2002.

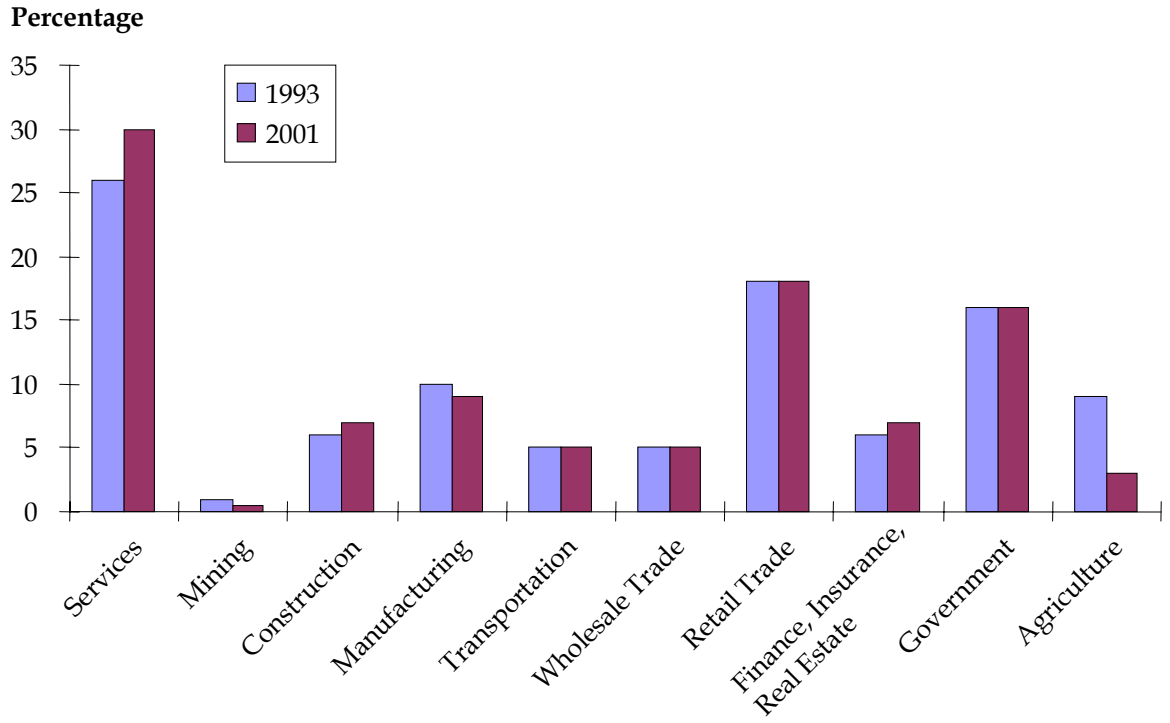
Population growth and change have significant implications for land use planning and its relationship with the transportation system in Arizona. Encouraging coordination between land use and transportation planning could improve Arizona's ability to address the transportation needs of millions of new residents over the next 20 years. Population growth puts pressure on all aspects of government, not least the transportation system. Phoenix already faces serious congestion problems that may intensify over the next 20 years. As other areas of the State grow, new problems will emerge.

A Changing Economy

Economic growth has largely maintained pace with population growth in Arizona. As with population, over 70 percent of jobs, personal income, and sales are generated in the Phoenix metropolitan area; an additional 15 percent is generated in the Tucson metropolitan area. Phoenix and Tucson are manufacturing centers attempting to attract high-technology development. Other urban areas, such as Flagstaff and Sierra Vista, are also

pursuing high-technology and "new economy" knowledge-intensive jobs. Economic development elsewhere in the State, in contrast, is generally quite different. Outside of the major urban areas, recreation-based employment, tourism, and services for retirees are key. Agriculture and mining also continue to play important roles, as they have throughout the State's history. The opportunities for international trade are growing, both along the Mexican border and also with major partners overseas. Figure 1.4 provides an overview of recent shifts in employment by industry.

Figure 1.4 Arizona Employment by Industry



Source: Arizona Department of Economic Security, 2002.

Population and economic growth, combined with national and international changes in goods production and movement, make freight movement a major issue for Arizona. Arizona is positioned to capture a large share of North American Free Trade Agreement (NAFTA) traffic, and could develop strategic linkages of suppliers to Maquiladora factories in Mexico. Maquiladora factories manufacture or assemble products for sale in the U.S., using inputs to their manufacturing processes from the U.S. At the same time, Arizona's largest trading partners are overseas, making Arizona (like all U.S. states) heavily reliant on the state and national transportation system to supply Arizonans with commodities. In addition, growth in small parcel shipments and overnight shipping means different types and numbers of trucks on the road.

Environmental Pressures

One of Arizona's greatest assets is its varied natural setting. The Arizona Department of Environmental Quality has actively pursued programs to improve the State's environment. Since the early 1990s, air quality has improved; and, today, few areas of the State are out of compliance with Federal air and water quality standards.

The continuing influx of residents and economic activity will increase pressure on Arizona's environmental resources. As the population center of the State, the Phoenix region faces the greatest challenge to maintaining air and water quality. The main markers of poorer environmental conditions are in Phoenix, where air pollution has reduced visibility in the region over the past several years. However, there has been no violation of the carbon monoxide and one-hour ozone standards since 1996. The state and local governments have implemented a wide variety of air quality measures to keep pace with growth.

Land preservation and sustainable growth are also major concerns in Arizona. The State has passed several laws in recent years aimed at preserving open space and improving the planning process, implementing a form of "smart growth" that has become increasingly popular in the United States.

The Urban/Rural Dichotomy in Arizona

Nearly two-thirds of Arizona's population live in metropolitan Phoenix. Arizona's five established metropolitan areas (Phoenix, Tucson, Yuma, Flagstaff, and Prescott) account for over 85 percent of the State's population. Compared to other similarly-sized Western states, Arizona's population is much more highly concentrated. Only Nevada, with over three-quarters of the population in Las Vegas and 95 percent in Las Vegas and Reno combined, is more centralized. Similarly-sized states in the South and Midwest exhibit different development patterns, with only 20 to 30 percent of their populations living in the largest metropolitan area.

State transportation planners should remain cognizant of two fundamentally different sets of issues and challenges facing urban and rural Arizona – persistent challenges to rural transportation systems and evolving challenges to existing and emerging urban areas. Mobility and other issues in rural Arizona remain on the agenda, and the State will need to be aware of its efforts to address them.

■ 1.3 Mission Statement, Goals, and Objectives

The strategic direction is an attempt by MoveAZ to address the major transportation issues and concerns facing the State. The review described above presented key themes that are reflected in the mission statement, goals, and objectives. These include a focus on

quality of life; the need for mobility; and an attempt to address the variety of issues raised by previous plans, the general public (see Chapter 2), and the Arizona context.

The strategic direction consists of three basic elements:

1. The **mission statement** provides a brief description of a desired future condition or set of conditions that is dependent on the outcomes of transportation policies and decisions, usually among a broader set of policies.

2. The **long-range goals** reflect the spectrum of major goals or desired outcomes expressed by both the mission statement and numerous planning efforts from around the State.

3. Performance factors may help describe multiple goals, but suggest different, more specific **long-range objectives** and strategies for action. These objectives are grouped into broad **performance factors** (e.g., "reliability" or "equity") that can be described and evaluated with more detailed performance measures (see Chapter 4).

This section of Chapter 1 provides the final strategic direction that resulted from the review of plans, analysis of major issues, consultation with internal and external advisory committees, and public involvement.

Figure 1.5 MoveAZ Mission Statement

To support Arizona's quality of life, the MoveAZ Plan will provide a safe, reliable, and efficient transportation system for people and goods that strengthens our economic vitality; assures access to services and recreational opportunities; preserves the beauty and health of our natural environment; and blends into our urban and rural landscapes.

To achieve these ends, the Move AZ Plan will:

- *Be fiscally responsible;*
- *Provide citizens with transportation choices;*
- *Emphasize accountability;*
- *Be responsive to change;*
- *Harmonize with Arizona's proud heritage and unique diversity;*
- *Encourage coordination of transportation and land use planning at the state, regional, and local level; and*
- *Address air, transit, rail, highway, bicycle, and pedestrian travel.*

Table 1.2 MoveAZ Goals and Objectives

Long-Range Goal	Long-Range Performance Objectives
Access and Mobility. A reliable and accessible multimodal transportation system that provides for the efficient mobility of people and goods throughout the State.	**Mobility Factor** • Maintain and enhance levels of circulation (e.g., reduced congestion) on highways, arterials, and major collectors. • Maintain and enhance the ability of goods to move through and around urban areas with minimal delay. • Encourage the development of transit options for economically-disadvantaged populations.
	Reliability Factor • Improve the availability and quality of real-time information to increase the ease of use and attractiveness of both highways and public transportation. • Reduce delay caused by at-grade highway-railroad crossings. • Develop and implement an access management program to preserve the reliability of the state highway system.
	Accessibility Factor • Encourage the development of effective public transportation, ride share, and related options, where appropriate, and cost effective. • Support Title 6 Americans with Disabilities Act (ADA) compliance for access by disadvantaged groups to all transportation services. • Integrate transit, bicycle, and pedestrian facilities into highway improvements, where feasible. • Maintain and enhance connections to major commercial, residential, and tourist destinations by both highways and public transportation. • Maintain and expand border crossing facilities.
	Connectivity Factor • Maintain and enhance intermodal passenger connections between air and surface (highway and transit) transportation modes. • Maintain and enhance intermodal freight linkages for truck-rail and truck-air transfers. • Continue necessary expansion and connection of Arizona's metropolitan highways and high-occupancy vehicle (HOV) lanes. • Ensure the connection of rural communities to the state highway network.
Economic Vitality. A multimodal transportation system that improves Arizona's economic competitiveness and provides access to economic opportunities for all Arizonans.	**Economic Competitiveness Factor** • Maintain and expand freight transportation and intermodal linkages. • Increase coordination of transportation planning with the economic development activities of state, regional, and local governments. • Equitably distribute transportation to all areas of the State.
	Accessibility Factor • Maintain and improve truck linkages between Arizona, other states, and Mexico. • Maintain and improve access to major tourist destinations. • Encourage the development of transit services that provide access to job centers.

Table 1.2 MoveAZ Goals and Objectives (continued)

Long-Range Goal	Long-Range Performance Objectives
Safety. Provide safe transportation for people and goods.	**Safety Factor** • Reduce the rate of crashes, fatalities, and injuries for motor vehicles, bicycles, and pedestrians. • Design new transportation facilities to minimize accidents. • Improve the safety of commercial vehicles, public transportation vehicles and facilities, and where modes intersect. • Upgrade at-grade railroad crossing protection. • Increase ADOT's support and use of incident management on the state highway system. • Coordinate with Federal, regional, local, and tribal officials to provide redundancy of access for emergency response and evacuation situations (e.g., bridge crossings, multiple access routes to airports and other key transportation facilities, etc.) • Improve safety and security for rural area travelers.
Stewardship. A balanced, cost-effective approach that combines preservation with necessary expansions and coordinates with local and regional transportation and land use planning.	**Preservation Factor** • Preserve and maintain existing transportation infrastructure. • Develop and implement an access management program to preserve the functionality of the state highway system. • Coordinate planned transportation system expansions with future funding capabilities. • Increase efficient coordination of state transportation planning and programming processes with local and regional land use planning processes. **Mobility Factor** • Increase and/or protect capacity of the existing transportation system through increased use of traffic operation and management strategies, including Intelligent Transportation Systems (ITS) methods.
Environmental Sensitivity. A transportation system that enhances Arizona's natural and cultural environment.	**Resource Conservation Factor** • Increase energy conservation and the use of recycled materials and cost-effective alternate energy sources. • Give preference to use of native or indigenous species in transportation-related landscaping projects. • Encourage the development of smart growth policies in coordination with state, regional, local, and tribal planning processes. • Increase proactive coordination of transportation planning with Federal, state, and regional environmental agencies. • Minimize the contribution of transportation investments to air, water, and noise pollution in all areas of the State. • Ensure that negative environmental impacts of transportation investments do not fall disproportionately on disadvantaged groups. • Minimize the impact of transportation investments on natural habitats, animal travel corridors, historic sites, and endangered species

2. Coordination and Public Partnering

Chapter 2. Coordination and Public Partnering

Coordinating with the public and stakeholders affected by transportation decisions is critical to the success of any transportation planning effort. Planning is the first stage in the development of transportation projects that can have major impacts on communities. As such, it is vital that the public be involved throughout the entire process.

MoveAZ included extensive coordination with regional planning agencies, local elected officials, transportation stakeholders, and the general public. This chapter describes the overall coordination and public partnering process and the links between public partnering and the other phases of the MoveAZ plan.

2.1 Coordination Process

As shown in Figure 2.1, the MoveAZ Plan included extensive coordination within ADOT, between ADOT and other regional and local planning agencies, and between ADOT and the general public. The coordination process included meetings with advisory bodies and other groups. The following four coordination techniques were used to support the MoveAZ plan:

1. **External Coordination –** The Working Group is a body composed of each of the regional planning agencies in the State, the Arizona Transit Association, and the ITCA. This group met throughout the development of MoveAZ and reviewed all material produced for the plan. The Working Group met 15 times between late 2001 and spring of 2004 to review deliverables and provide guidance in the development of the plan.

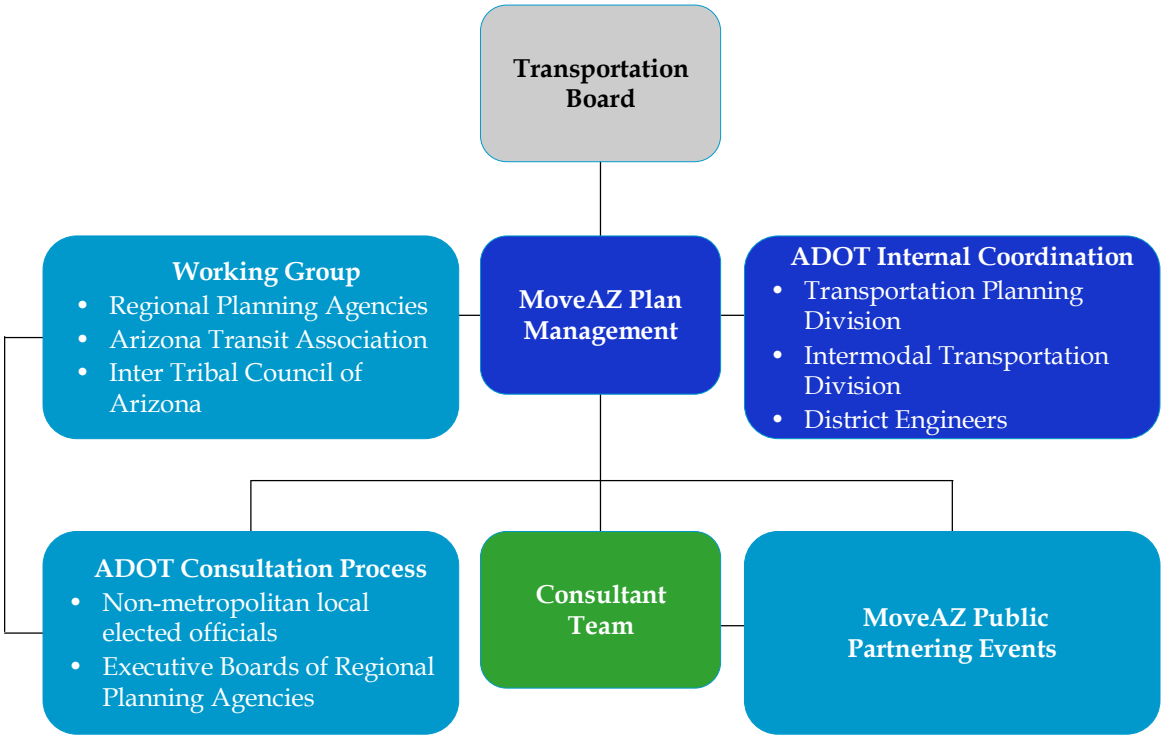
2. **Internal Coordination –** MoveAZ included internal coordination through two bodies – a steering committee and a continuity team. The steering committee was comprised of Transportation Planning Division (TPD) staff representing planning, programming, air quality, data and asset management, and each of TPD's regional planners. This group met 15 times in coordination with the Working Group meetings described above. The Continuity Team is a body composed of internal ADOT staff (including the ADOT Deputy Director, the state engineer, and a district engineer) and other staff from ADOT's Intermodal Transportation Division. This group helped ensure that MoveAZ was consistent with existing ADOT policy and practice. The Continuity Team met six times over the period beginning in 2002 through spring of

2004 for progress briefings and to ensure coordination of the plan with other ongoing ADOT activities.

3. **Public Partnering –** Fifty public meetings were held across three phases, starting in the fall of 2002 and completing in the spring of 2004. The specific meetings are described in detail in this chapter.

4. **Consultation Process –** ADOT consults with the executive boards of regional planning agencies and other agencies that request information about ADOT planning and other activities. In addition, the Federal Highway Administration (FHWA) requires ADOT to consult with non-metropolitan, local-elected officials regarding planning. These activities occur independently of the MoveAZ Plan, but were also used during the MoveAZ process to provide information to these groups. ADOT conducted over 20 meetings with local-elected officials and the boards of regional planning agencies to discuss MoveAZ. These meetings are part of an ongoing coordination process that overlaps the MoveAZ plan.

Figure 2.1 MoveAZ Coordination Process



2.2 Public Partnering Process

Partnering events were opportunities to build stronger partnerships with key public and stakeholder groups. These events were formulated around three key phases of the MoveAZ Plan:

1. The definition of strategic directions, goals, and objectives;
2. The evaluation of alternative policies and projects; and
3. The creation of the draft plan.

Each of the three phases included multiple partnering events, as shown in Table 2.1. The following subsections describe the purpose of each phase and event.

Table 2.1 MoveAZ Public Partnering Events

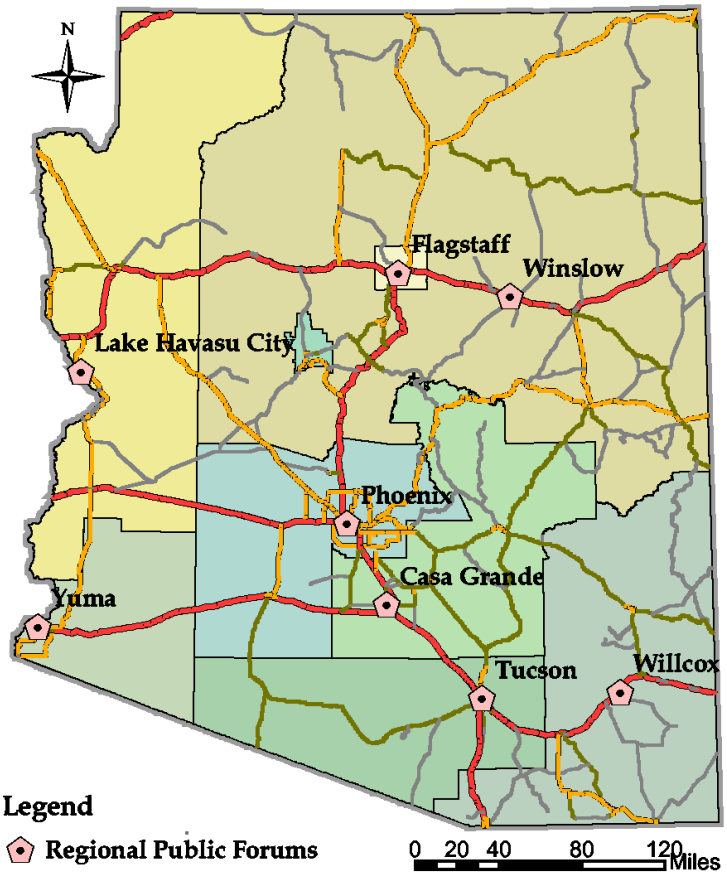
Partnering Phase	Dates	Events
Initial	Fall 2002	Regional Public Forums
		Focus Groups
Intermediate	Spring 2003	Regional Solutions Forums
		Focus Groups
Final	Spring 2004	Open Houses

Initial Partnering Events

The initial partnering phase of public involvement provided public input to confirm and refine the strategic direction, and to help prioritize the long-range goals and objectives developed during Phase I. In addition, ADOT gained a greater understanding of the transportation issues facing Arizona through the concerns and suggestions presented by stakeholders and the general public. Two events were held in this phase:

1. **Regional Public Forums**, intended to assess the transportation issues and concerns of the general public (Figure 2.2); and

Figure 2.2 MoveAZ Regional Public Forum Locations



2. **Focus Groups**, providing targeted assessment of the perspectives of specific stakeholders. These groups included:

   a. Aviation;

   b. Transit providers and users;

   c. Bike and pedestrian interests;

   d. Commercial vehicle operators, railroads, and distribution firms;

   e. Economic development interests (economic development organizations, industry associations, chambers of commerce);

   f. Health and human services providers;

   g. Native American communities;

   h. Pipeline and utility representatives; and

   i. Environmental concerns (state and national parks and forest service, air quality planners).

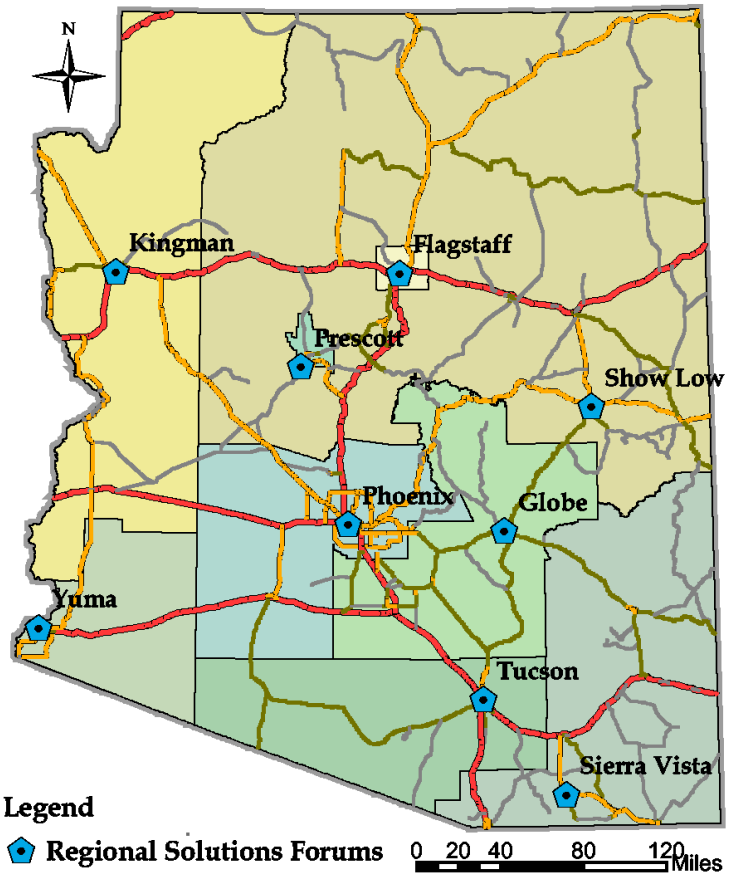
A detailed report describing the initial partnering events can be found in Appendix B.

Intermediate Partnering Events

The intermediate partnering phase was used to evaluate the acceptability of policies and strategies developed in response to issues, concerns, and ideas expressed during the initial partnering phase and as a result of the research completed. The intermediate phase provided additional public input and built a level of confidence to move forward in the development of the draft plan. Nine regional solutions forums were held throughout the State, as shown in Figure 2.3. A second round of stakeholder focus groups was also held with the following groups:

- Native American communities;
- Transit providers and users; and
- Commercial vehicle operators, economic development, and aviation interests.

Figure 2.3 MoveAZ Regional Solutions Forum Locations



The insight gained as a result of the focus groups and forums will be used in discussions and debates regarding potential policies and strategies to improve the performance of the overall system.

The intermediate partnering phase provided important input for the development of weights that were applied in the performance analysis process (described in Chapter 4). Participants at the forums also had the opportunity to identify potential projects and policies for the State's future transportation system. Chapter 3 includes a review of the key policy suggestions received during these and other events.

A detailed report describing the intermediate partnering events can be found in Appendix C.

Final Partnering Events

The final partnering events consisted of 20 open houses held across the State, as shown in Figure 2.4. These events presented material from the draft MoveAZ Plan to the public. From the strategic direction through the analysis of projects, participants had an opportunity to review information about the plan through display boards, copies of MoveAZ documents, and informal discussions with ADOT representatives. The open houses provided a forum to discuss the performance-based analysis process with the public, as well as gauge public response to the overall planning process.

A detailed report describing the final partnering events can be found in Appendix D.

Communication Plan

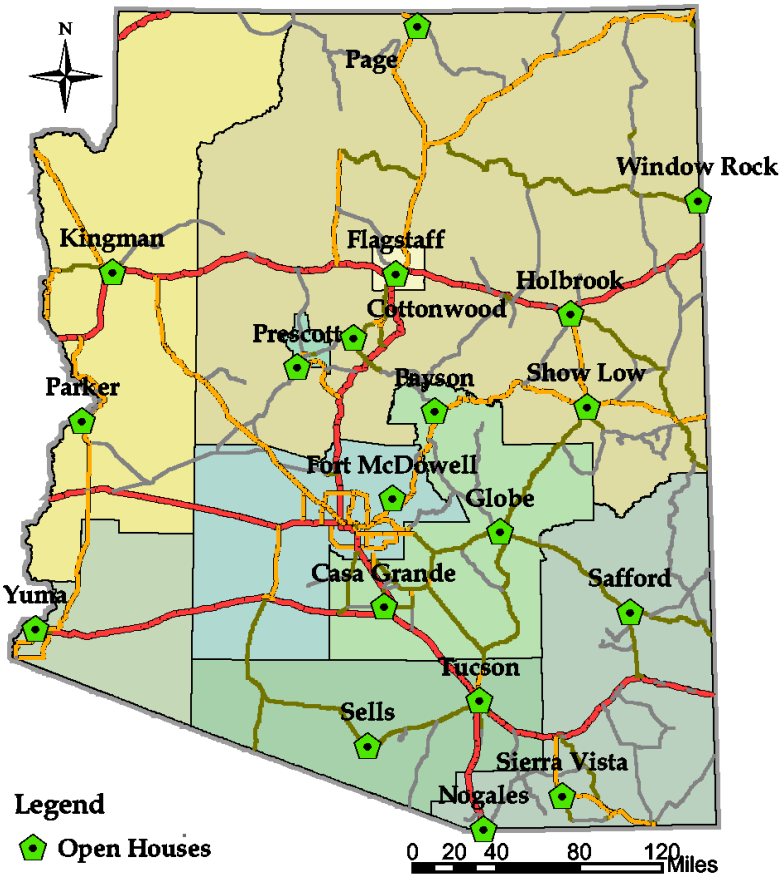
In addition to the three rounds of public events, MoveAZ included an ongoing communication plan. Regular communication through newsletters, mailings, and a web site provide additional avenues for the public to learn about planning and to comment on MoveAZ. The communication plan included the following strategies:

- **Press releases** were provided to newspapers, chamber of commerce newsletters, radio stations, and other local and regional publications. This provided broad media coverage of the events and a general invitation to the events.

- **Direct mailings** provided an opportunity to specifically invite interested individuals to the public partnering events. Individuals who participated in early events were invited to subsequent events in their area.

- A **brochure** was created to describe the overall purpose of the plan and the basic outline of the strategic direction. This brochure was available at all public partnering events.

Figure 2.4 MoveAZ Open House Locations

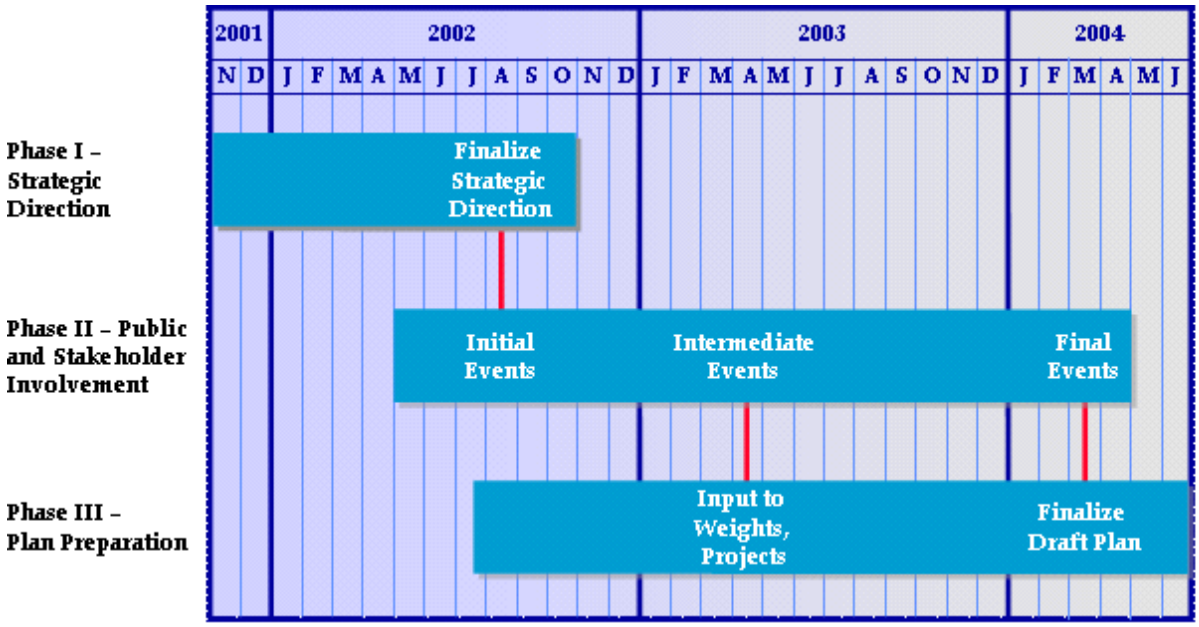


- A **newsletter** was produced to provide information to the public about the plan.
- Finally, a **web site**, http://www.moveaz.org, was regularly updated to provide information on the plan to the public. The web site was also the central repository for all planning documents.

2.3 Public Partnering Results

This section describes key results from the public partnering events. These events provided two main benefits: they helped educate the public about transportation planning in Arizona and they helped ADOT understand the general priorities and strategies the public preferred. Each round of public partnering events was intended to inform a particular phase of the MoveAZ Plan, as shown in Figure 2.5.

Figure 2.5 Connections Between Public Partnering and the MoveAZ Plan



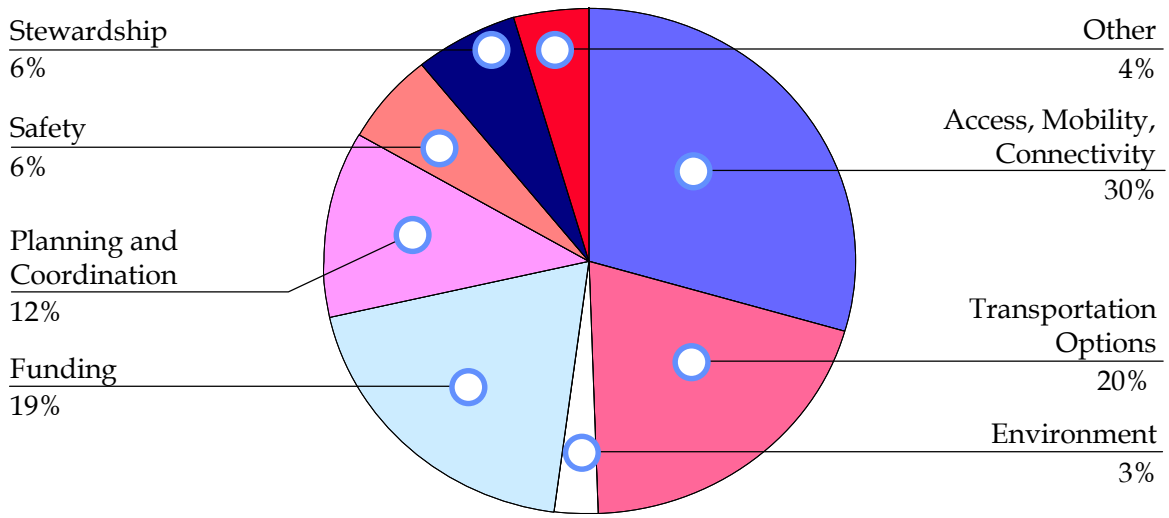
Initial Partnering Results

The initial partnering events focused primarily on finalizing the strategic direction. Participants provided information about their best transportation experience, major transportation issues in their region and the State as a whole, and reacted to a preliminary set of long-range goals. In addition to the interactive discussion, each participant received a survey with 15 questions that provided another opportunity for participants to describe their concerns about transportation in Arizona.

As shown in Figure 2.6, comments received during the initial partnering phase reflect many of the long-range goals identified for the plan. Participants also identified issues outside the scope of the plan, such as the availability of funding. In addition, the priorities of Arizonans began to emerge in this first phase. Several of the key concerns expressed in the first phase warrant closer attention.

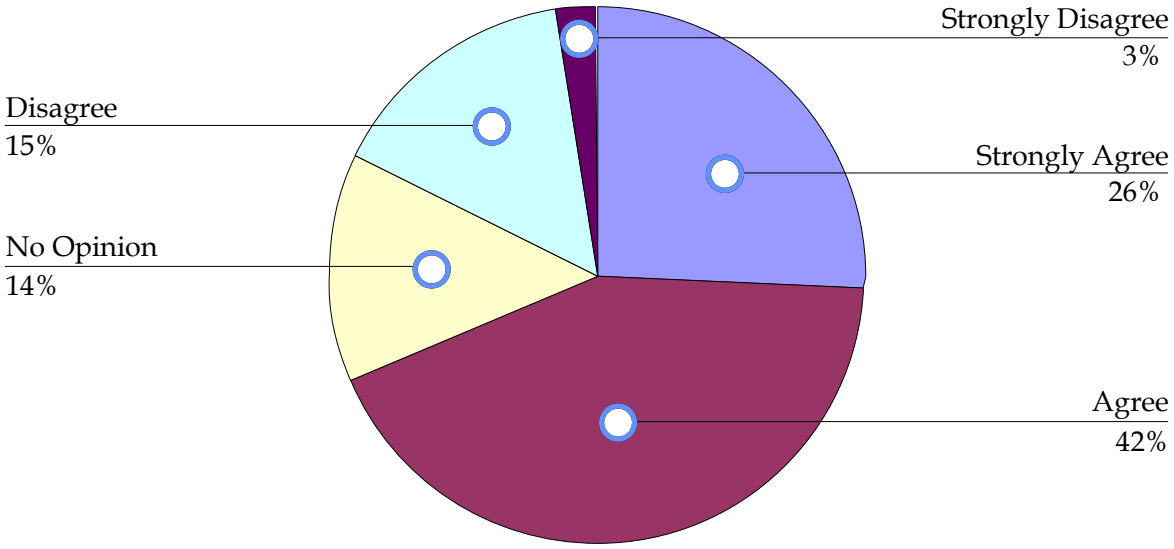
Mobility was a key issue in the regional public forums and all other events. Arizonans understand that the State is growing rapidly and must address congestion and mobility issues. Similarly, participants at public forums expressed considerable concern about their ability to move easily between major cities.

Figure 2.6 Distribution of Participant Concerns Across All Forums



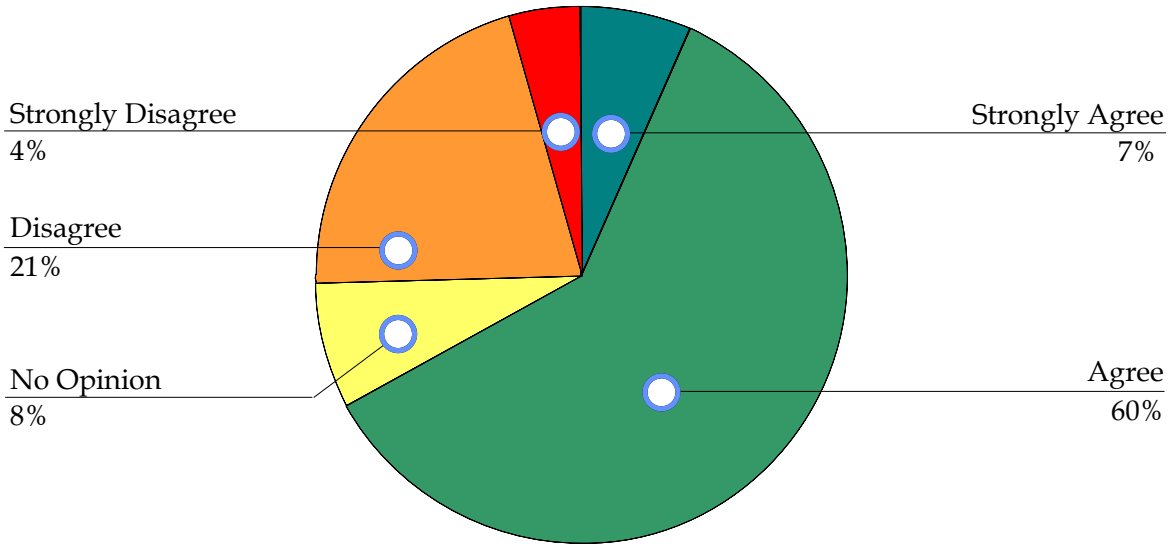
A second major issue that arose in the forums and focus groups was the need for transportation options, such as transit or improved air service. These concerns were spread across several modes and reflected a growing interest in alternatives to the automobile. As shown in Figure 2.7, most participants felt that cities should take the lead in planning and developing transit options. (ADOT's role in transit, air service, and other modes is discussed in detail in Chapter 7.)

Figure 2.7 Response to Survey Statement: "Cities Should Take the Lead in Planning and Developing Transit"



Stewardship and preservation issues were not mentioned as frequently as other issues in the public forums, but this may reflect the existing quality of Arizona's road system. When surveyed about the maintenance of the roads in Arizona, two-thirds of participants believed the system was well maintained (Figure 2.8).

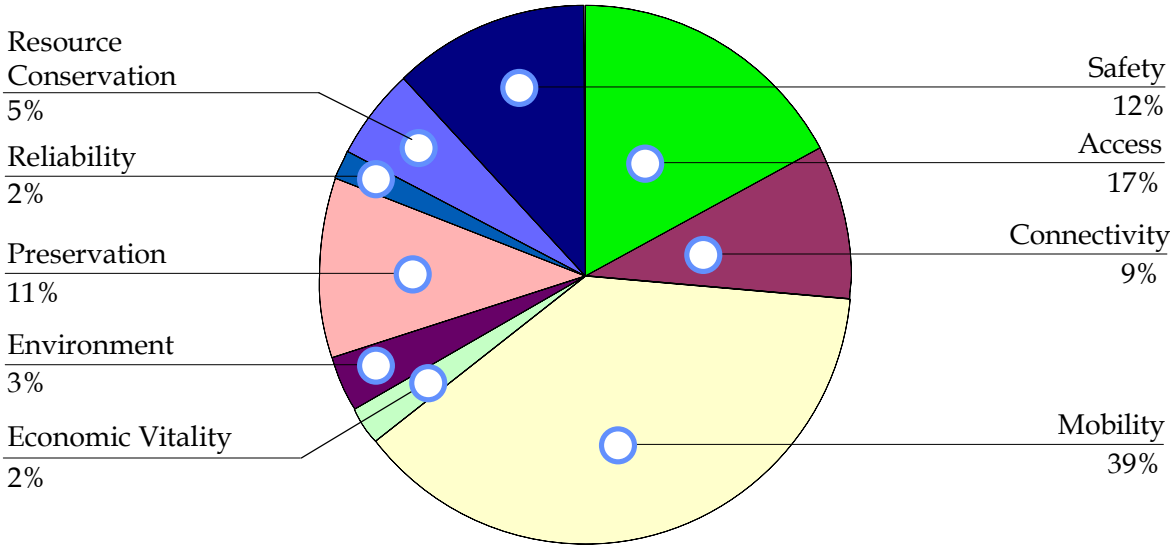
Figure 2.8 Responses to the Statement: "The Overall Maintenance of State Roadways in this Region Is Good"



Intermediate Partnering Results

In the intermediate phase, participants suggested strategies and solutions related to the performance factors that are part of the strategic direction. Participants identified their preferred project and policy solutions through facilitated discussions, and then voted on all comments together. Participant statements were coded by the relevant performance factor, and these results were tabulated to provide a rough understanding of priorities of Arizonans. Strategic recommendations by performance factor are shown in Figure 2.9.

Figure 2.9 Strategic Recommendations by Performance Factor



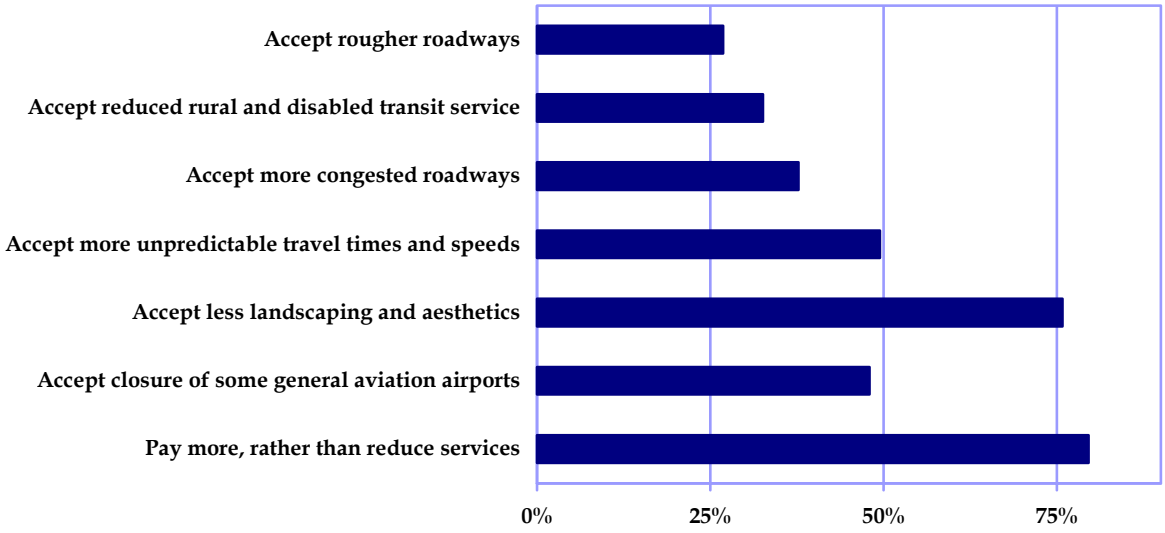
Source: Cambridge Systematics, Inc., 2003.

The priorities gathered from the regional forums supported the development of performance factor weights. Participant comments suggested that mobility was the primary concern, with other major concerns including accessibility, safety, and preservation. The process for developing weights used participant ranked priorities, as well as information from ADOT and the Transportation Board. Chapter 4 provides a more detailed description of the development of performance factor weights.

To provide additional information about priorities, the regional solutions forums included a survey that asked participants to make tradeoffs between different policy and project solutions. One of the key questions asked what changes participants would most likely accept if less funding were available (Figure 2.10).

Overall, participants were reluctant to accept reductions in services, with over three-quarters of respondents indicating they would prefer to pay more, through taxes or user fees, to retain services and maintain system performance. Funding issues were also frequently raised during facilitated discussions. Policy issues related to funding and other issues are described in detail in Chapter 3.

Figure 2.10 Acceptance of Changes to Transportation Services

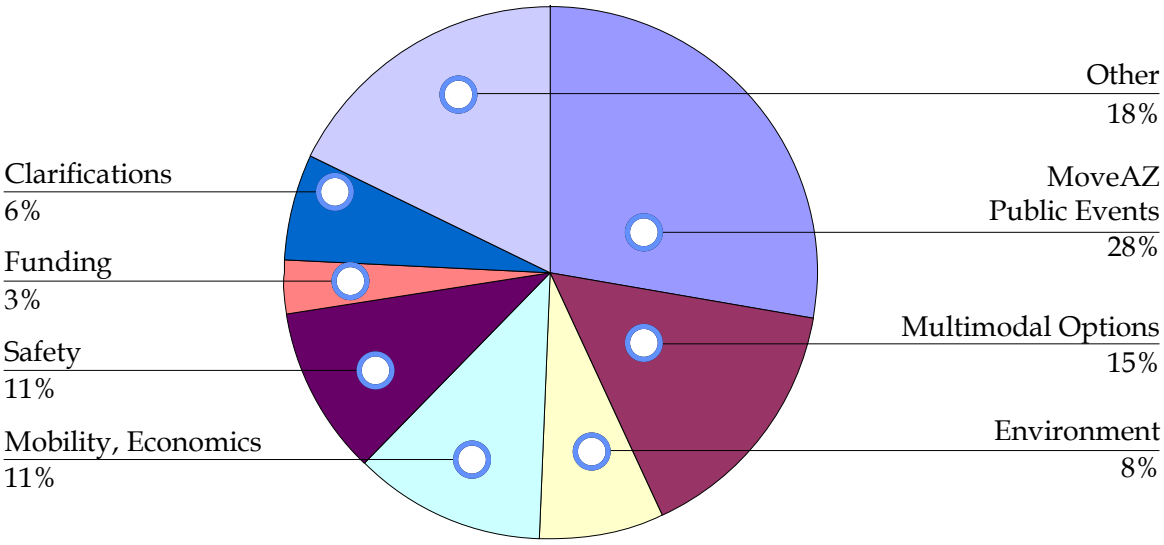


Reaction to the Draft Plan

The final partnering phase provided open house participants with an opportunity to react to the draft plan. At the open houses, a series of stations, or booths, were set up to address the various aspects of the plan, including the strategic direction, public partnering, performance-based analysis, and project evaluations. Participants had an opportunity to provide comments at each of the stations, as well as general comments about MoveAZ. In addition, ADOT representatives held informal discussions with open house attendees.

ADOT received over 200 comments at the open houses. Over one-quarter of these comments were made in reference to either the MoveAZ planning process or public involvement process. These comments largely thanked ADOT holding open houses and other events in their communities. Many of the other comments received at the open houses reflected concerns raised during the initial and intermediate partnering events (Figure 2.11). These concerns include the need to pursue multimodal transportation options, such as improved transit and increased air service to rural areas of the State; the need to improve the safety of the state transportation system; and the importance of mobility to support the economic well being of the State and its residents.

Figure 2.11 Primary Subject of Comments Received at MoveAZ Open Houses



3. Policy Directions

Chapter 3. Policy Directions

The MoveAZ Plan was developed to be consistent with policies and procedures adopted by the Arizona legislature and the Arizona Transportation Board, the two bodies that set policy for transportation in the State. This chapter describes the relationship between ADOT's current transportation policies and the MoveAZ Plan, identifies key policy decisions made during the development of the plan, and discusses the policy suggestions received during MoveAZ public partnering events.

3.1 ADOT Transportation Policies

Both the legislature and the Transportation Board provide policy direction for the MoveAZ Plan. Although the legislature vests the Board with ultimate authority over the projects and programs to be funded in Arizona, key laws identify specific procedures that ADOT must follow in planning and delivering projects. This section describes the legislative requirements that shape the plan and the relationship between Transportation Board policies and MoveAZ.

Legislative Requirements

Both Federal and state legislation require ADOT to develop a long-range transportation plan. For the State, House Bill 2660, adopted into law in the 2002 legislative session, sets several guidelines on the development of a long-range plan:

- The updated law governing ADOT explicitly requires the use of performance-based planning in both the long-range plan and the five-year capital program. The five-year program is the mechanism ADOT uses to identify specific capital projects to be constructed.

- The updated law identifies several performance factors that ADOT must address in planning. These are discussed in more detail below.

- The updated law requires consistency with local planning, including requiring the long-range plan to use local and regional land use plans; to facilitate, not direct, growth; and to coordinate with regional planning efforts. It also requires local and regional agencies to submit a standardized report of their transportation needs to ADOT each year.

MoveAZ was designed to be consistent with these requirements. It is a 20-year plan that uses performance measures to evaluate major capital projects, as described in Chapter 4. It uses official population projections from the Arizona Department of Economic Security. It includes a process to coordinate with regional planning agencies, including a procedure for using estimates of land-use patterns and traffic growth developed by regional planning organizations, where these were available. Finally, MoveAZ incorporates the specific performance factors required by House Bill 2660. These performance factors are described below.

Performance Factors

The updated law now requires ADOT to address specific performance factors. The relationship between these required factors and the MoveAZ performance factors is shown in Table 3.1.

Table 3.1 Comparison of HB2660 and MoveAZ Performance Factors

HB 2660 Performance Factor	Relevant MoveAZ Performance Factor(s)
• System preservation	• Preservation
• Congestion relief	• Mobility
• Accessibility	• Accessibility
• Integration and connectivity with other modes	• Connectivity; accessibility
• Economic benefits	• Economic competitiveness; accessibility
• Safety	• Safety
• Air quality and other environmental impacts	• Resource conservation
• Cost effectiveness of a project or service	• See Note 1
• Operational efficiency	• Mobility; reliability; preservation (see Note 2)
• Project readiness	• See Note 3

Notes:

[1] Although MoveAZ does not include a specific factor for cost effectiveness, it uses tools that allow for basic cost/benefit analyses. In addition, cost estimates were made for each project that allow a comparison of the "cost per performance gained" of each project.

[2] Operational efficiency may be defined in several ways, including 1) the efficient movement of people and goods, 2) the ability to reliably plan a trip on the transportation system, and 3) the minimization of replacement costs through proactive maintenance. These three definitions of operational efficiency are addressed, respectively, by the mobility, reliability, and preservation performance factors.

[3] Project readiness is more applicable to the programming process than to the development of a 20-year plan. This factor is used in transitioning from MoveAZ to the five-year program, as described in Chapter 9.

Transportation Board Policies

The Transportation Board also adopts policies that guide transportation-related activities in the State. The Board has an existing policy statement, updated periodically, that is relevant to transportation planning. This statement, most recently updated in August 2003, addresses four basic types of policies:

1. **System policies**, which describe the functional goals that ADOT would like to achieve and are similar to the goals outlined in the MoveAZ strategic direction. More detail on the overlap of the system policies and the strategic direction is provided below.

2. **Coordination policies**, which propose improved coordination with Federal, state, regional, tribal, and local agencies. These policies are reflected in the coordination effort that was part of the MoveAZ development process (see Chapter 2).

3. **Procedural policies**, which describe the process that ADOT should use for planning, as opposed to the specific substantive outcomes addressed by the system policies. These policies include requirements for public involvement, performance-based planning, and non-discrimination in contracting.

4. **Financial policies**, which state the Board's position on financial matters. They include recommendations on ways to acquire additional funds for transportation investments and requirements that ADOT follow Governmental Accounting Standards Board accounting principles.

ADOT's coordination, procedural, and financial policies, shown in Table 3.2, helped guide the development of the MoveAZ Plan. They provided general guidelines for coordinating with other agencies, working with the public, identifying funding constraints, and addressing other relevant policies and procedures. In addition, MoveAZ addresses each of the system policies. Table 3.3 describes the relationship between the system policies and the MoveAZ long-range goals.

3.2 Key Policies Related to MoveAZ

During the MoveAZ process, several specific policies were adopted or refined that affected the development of MoveAZ. These policies included a new statewide transportation planning policy, a regional funding policy, a Maricopa Association of Governments (MAG) Regional Transportation Plan (RTP), and specific corridor definition studies to support future planning in and adjacent to the MAG region. Each of these policies is examined in more detail below.

Table 3.2 Transportation Board Financial, Procedural, and Coordination Policies

Policy Type	Short Policy Description (Policy Number)
Financial	• Increase funding, issue debt (19, 32) • Practice fiscal restraint (27, 31, 32) • Encourage local and private funding (28) • Comply with GASB standards (35)
Procedural	• Transfer bypassed road segments to local control (16) • Consider requests to name or rename highway features (17) • Develop a performance-based, long range plan and five-year program (2, 20, 21, 22) • Ensure non-discrimination in contracts (33, 34) • Encourage public participation in transportation decisions (2, 36)
Coordination	• Coordinate with regional governments, stakeholders (3, 21, 37) • Work with Federal, state, and international agencies (3, 37, 38)

Table 3.3 Transportation Board System Policies and Their Relationship to the MoveAZ Goals

MoveAZ Goal	Short Policy Description (Policy Number)
Access and mobility	• Prioritize highways that connect Arizona, its regions, and population centers with other states and with Mexico (5) • Provide HOV lanes and related facilities, consider congestion pricing and high-occupancy toll (HOT) lanes (14) • Facilitate and encourage public transportation, bicycling, walking, and the interconnection of modes (1, 4, 6, 7, and 24) • Encourage effective and efficient operation at ports of entry (23) • Support regional and interregional public and special needs transportation planning (23)
Stewardship	• Establish minimum standards, make investments based on classification of highways by purpose and importance to the system (11) • Preserve the functional integrity of the state highway system through a comprehensive access management program (12) • Implement effective and efficient planning and construction processes, including value engineering, design build, and other mechanisms (29) • Implement asset management systems and methods (30)

Table 3.3 Transportation Board System Policies and Their Relationship to the MoveAZ Goals (continued)

MoveAZ Goal	Short Policy Description (Policy Number)
Economic vitality	• Facilitate goods movement throughout the State to maintain a strong state and national economy; work with rail, truck, and shipping industries to identify opportunities to increase efficient transport (8) • Consider preserving rail corridor property threatened by abandonment as an important resource for future transportation purposes (9) • Support effective and efficient operations at Arizona's ports of entry to ensure enforcement of Federal and state laws (15)
Environmental sensitivity	• Integrate air quality concerns in all processes (10) • Use Congestion Mitigation and Air Quality (CMAQ) improvement funds for transportation projects and programs in non-attainment and maintenance areas that reduce transport-related emissions and congestion (25) • Support early partnering with resource agencies in planning, design, and construction of transportation facilities and services (38) • Promote projects that provide amenities beyond roadway projects (26)
Safety	• Provide a safe, efficient, and effective transportation system (3) • Encourage public transit that improves the safety and efficiency of the state transportation system (6) • Provide rest areas for motorist services and safety (13)

Statewide Transportation Planning Policy

The law updated by House Bill 2660 requires the Transportation Board to adopt a long-range planning policy for the State. Working with ADOT, the Board reviewed and adopted the MoveAZ strategic direction as this long-range transportation planning policy. The strategic direction addresses the key goals and objectives that ADOT would like to achieve through long-range planning. It also identifies performance factors consistent with those required by House Bill 2660. The policy statement is the same as the strategic direction presented at the end of Chapter 1.

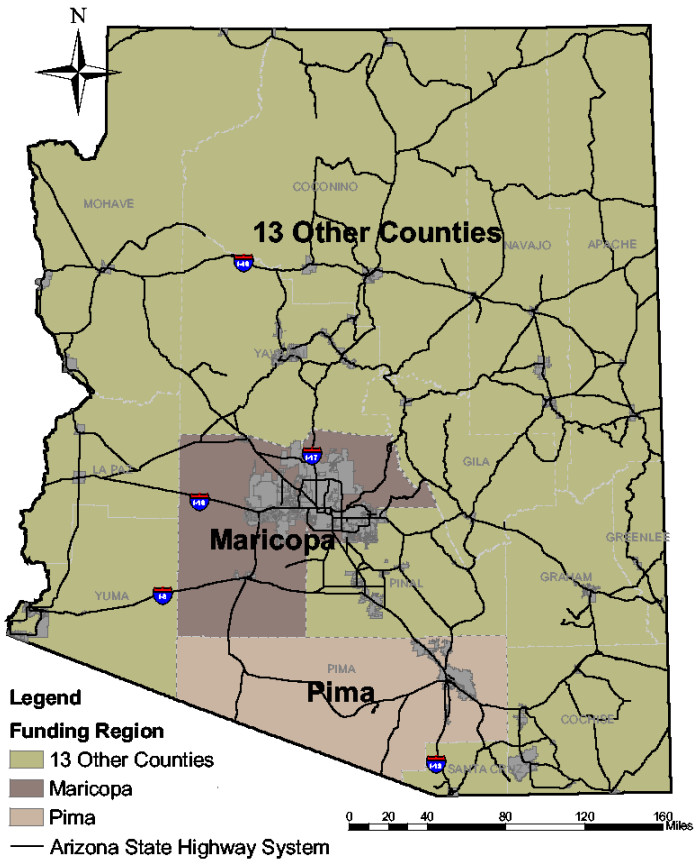
Regional Funding Policy

For several years, the Transportation Board has distributed funding around the State in accordance with recommendations from its Resource Allocation Advisory Committee (RAAC). As shown in Figure 3.1, the RAAC recommended that capital funding used for

the last several cycles of the five-year Transportation Facilities Construction Program be split among three major regions of the State: 37 percent for Maricopa County, 13 percent for Pima County, and 50 percent for the 13 other counties.

This funding split has been adopted for the MoveAZ Plan. The financial forecasts, described in Chapter 4, utilize this split among the three regions.

Figure 3.1 Transportation Board Funding Regions



Maricopa Association of Governments Regional Transportation Plan

As described in Chapter 2, the MoveAZ process included close coordination with regional planning agencies throughout the State. In the Maricopa region, this meant working with MAG, the metropolitan planning organization for Maricopa County.

In November of 2003, MAG completed a comprehensive 20-year RTP. Both the MAG plan and MoveAZ use performance-based planning methods to evaluate transportation conditions in their respective jurisdictions. The methods developed were overlapping and complimentary, each one tailored to its specific situation. MoveAZ covers the entire State,

but addresses state-owned transportation facilities and services only. The MAG plan covers Maricopa County only, but addresses all transportation facilities and services, including arterial streets, transit, bicycle paths, and other systems, as well as state highways. As a result, MAG includes several performance measures that are tailored to specific transportation modes or roadway functional classes.

As part of the coordination process designed for MoveAZ, the Transportation Board voted in November 2003, to support the MAG RTP. The funding available to Maricopa County (37 percent of ADOT capital funds) will be available to support the RTP. Like MoveAZ, MAG used a performance-based process to be consistent with the requirements of the law, as updated by House Bill 2660.

Corridor Definition Studies

MAG has authority over regional transportation planning in Maricopa County, but the Phoenix metropolitan area is rapidly growing to include portions of Pinal County. House Bill 2292 requires the MAG RTP to consider the impact of growth on roads in contiguous counties, such as Pinal. To support this effort, MAG, the Central Arizona Association of Governments (CAAG), and ADOT conducted a *Southeast Maricopa/Northern Pinal County Area Transportation Study*, published in September 2003. This study identified four potential corridors extending from within the MAG region into Pinal County for additional study:

1. **The U.S. 60 Freeway Extension** would extend the freeway portion of U.S. 60 from its current terminus at Goldfield/Baseline Road in Maricopa County to Ray Road in Pinal County. Built on state-owned land, this seven-mile highway would parallel the current U.S. 60 to the south. Projected traffic volumes range from an average of 35,000 to 65,000 vehicles per day in 2025. The cost of constructing the freeway extension is estimated at $117 million.

2. **The Williams Gateway Freeway** would connect Loop 202 in Maricopa County eastward to U.S. 60 in Pinal County. This corridor would extend for approximately 15 miles, with traffic volumes ranging from an average of 60,000 to 100,000 vehicles per day in 2030. Construction costs are estimated at $750 million, of which $325 million has been identified in the MAG RTP for the six-mile segment in Maricopa County.

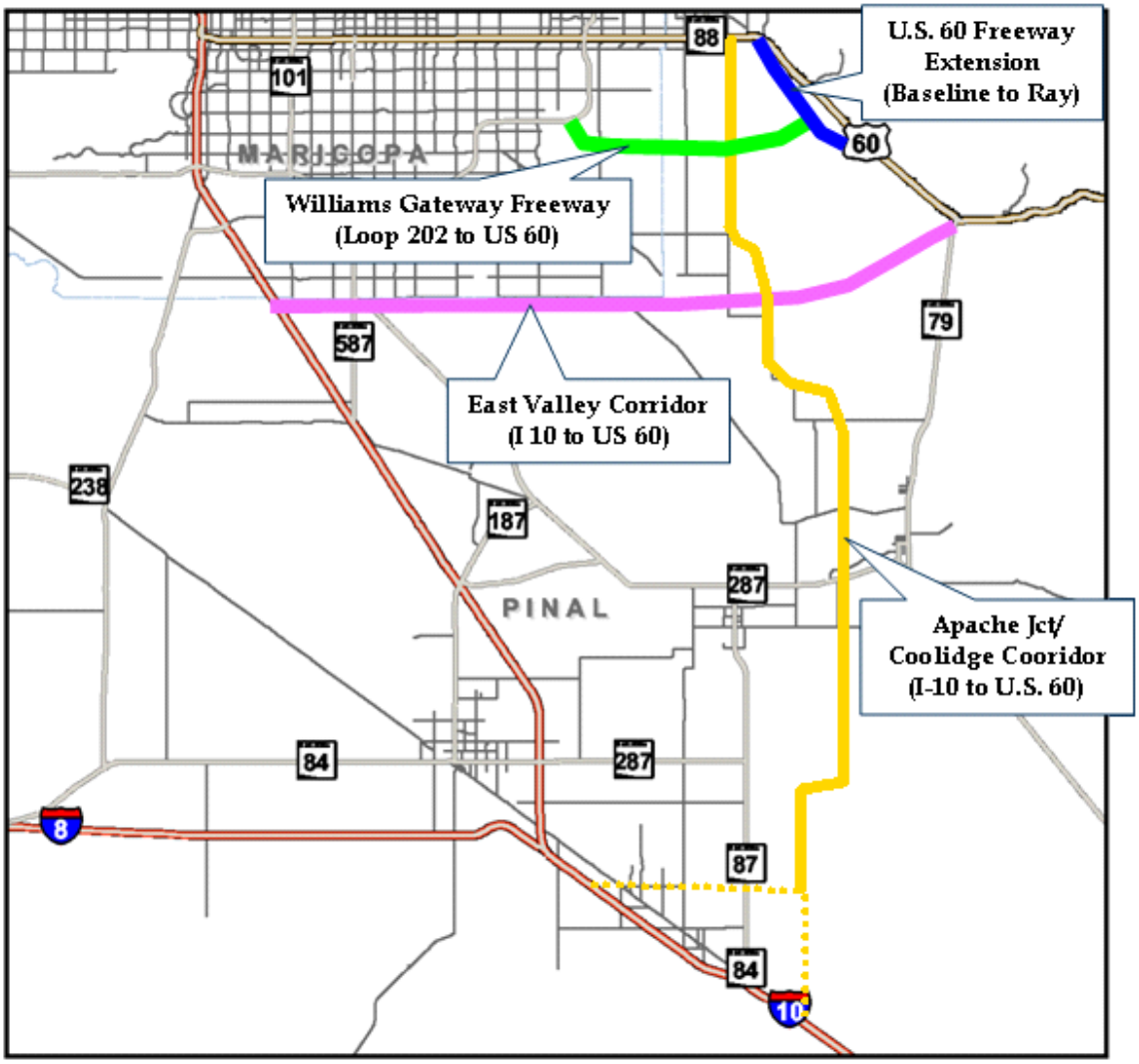
3. **The East Valley Corridor** would be a new corridor that parallels or overlaps the Hunt Highway along the southern boundary of Maricopa County. Extending approximately 31 miles from I-10 eastward to U.S. 60 in Pinal County, it would carry between 64,000 and 110,000 vehicles per day in 2030. The cost of the new facility would be $1.4 billion, if constructed as a freeway; and $310 million, if constructed as an expressway/controlled access arterial.

4. **The Apache Junction/Coolidge Corridor** would be a new corridor, entirely in Pinal County, that would follow SR 87 about 36 miles from Coolidge northward to U.S. 60 in

the vicinity of Apache Junction. If built as a freeway, the corridor would carry between 46,000 and 110,000 vehicles per day in 2030 and cost $1.6 billion to construct.

The Transportation Board has directed ADOT to develop studies to examine the need for each of the four proposed corridors, their ability to accommodate anticipated future growth, and the performance impacts of each corridor on other regional and state roads. The four corridors for future studies are shown in Figure 3.2. The figure shows the general location of the four corridors, not the precise route. The studies will identify the need for the corridor and potential alternative routes. The studies are expected to begin in the summer of 2004, and will be conducted by ADOT in conjunction with MAG, CAAG, Pinal County, and the local communities concerned.

Figure 3.2 Corridor Definition Study Locations



3.3 Policy Recommendations from Public Partnering

At each of the public partnering events, ADOT received suggestions for updated and transformed transportation policies. During the intermediate partnering events, participants were explicitly asked to identify policy solutions to their transportation concerns, and were provided with an opportunity to vote and rank the key policy solutions they suggested.

ADOT received nearly 300 individual policy suggestions at these forums. The policy suggestions covered a wide range of issues, but several key policy issues emerged more frequently than others, including funding, transportation options, and system stewardship. This section documents the policy suggestions received at the intermediate partnering events. The policies suggestions described are for informational purposes, and are not endorsed by ADOT.

Policies Related to Funding

More than 60 percent of the policy recommendations were related to funding. Participants showed great concern over how Arizona's transportation projects and programs will be funded during the next 20 years. Multiple comments suggested that current funding methods will not be adequate in the future. Participants encouraged ADOT to identify creative new ways for funding transportation projects, examine the distribution of funding throughout the State, and support funding of various modes of transportation.

Many similar recommendations were reiterated across forums:

- To generate funding, participants recommended policies, such as instituting toll roads and vehicle-related user fees (e.g., mileage-based user fees and fees for commercial vehicles). Of the funding recommendations made, over 10 percent supported increasing the state gas tax.

- Several participants suggested that Highway User Revenue Funds (HURF) should only be allotted to capacity projects, and not be made available to other agencies, such as the Department of Public Services.

- Participants also suggested that HURF funds not be restricted to highways only (as they currently are), but also be available to fund alternate modes, especially transit.

- A number of participants recommended that additional funding opportunities be available for Indian tribes.

Policies Related to System Stewardship

Many participants noted that roads currently are well preserved and maintained, and that preservation and sustainability of current resources should be a major priority for the state transportation system. At the Sierra Vista forum, over one-half of the policy recommendations were related to preservation. Many participants across the State agreed that a certain level of funding should be earmarked annually to maintain the current system.

Participants throughout the State also identified the need for more coordination between transportation and land use planning, and encouraged increased cooperation between state and local governments as a way of meeting that need. Several participants suggested giving regional governments control over both land use and transportation to provide more consistent development.

Policies Related to Transportation Options

Many of the policy recommendations, as well as issues identified during the initial partnering phase, called for increased transportation options. Participants supported policy developments that would encourage increased mobility throughout Arizona for both people and goods. Participants in Prescott and throughout the other forums urged ADOT to take the lead in advocating and developing alternate modes of transportation, and to develop a separate transit department within ADOT. Some of the specific recommendations included:

- Studying rail as a viable transportation option for the State;
- Restoring funding to the Local Transportation Assistance Fund, a mechanism to provide operating funding to rural transit operators;
- Supporting additional bicycle and pedestrian services by increasing regional funding for bicycle facilities and considering bicyclist and pedestrian needs in roadway design;
- Developing multimodal corridors with right of way provided for transit, rail, and bicycles;
- Protecting the Aviation Trust Fund from other uses; and
- Ensuring that rural airports be able to provide emergency response and evacuation services.

Many participants suggested that the key to creating a multimodal system that serves the entire State depends upon securing legislative support. Participants in the Phoenix forum, for example, strongly recommended that funding in urban areas be reallocated toward transit development, suggesting this could be handled at the legislative level, possibly through the development of a regional transit authority. Participants in rural areas recommended that Congressional changes be pursued to increase the percentage of funding

allocated to transportation funding and, specifically, the amount designated for rural transportation infrastructure.

Other Policy Recommendations

Various policy recommendations were made that either did not fall under the categories of funding, transportation options, or preservation; or that were not broadly supported across all forums.

- Many policy recommendations referred to increased safety measures, such as increased coordination with the Office of Homeland Security for evacuation routes and additional public education and outreach;

- Some participants suggested improved coordination with Arizona Department of Game and Fish in the development of roadways to address wildlife issues;

- Several comments were made regarding the structure of ADOT and the state transportation board, usually supporting the current structure of the ADOT Board;

- Participants in several forums mentioned the need for increased cooperation and communication between state organizations and communities;

- Participants encouraged ADOT to be the leader in facilitating communication with the State's council of governments, regional planning organizations, and Indian tribes; and

- During the consultation process, conducted concurrently with MoveAZ public events, several non-metropolitan, local-elected officials raised concerns about litter along state highways, and suggested that the legislature increase funding for roadside maintenance.

4. Performance-Based Evaluation Process

Chapter 4. Performance-Based Evaluation Process

At the core of the MoveAZ Plan evaluation process is an analysis of the system performance impacts of major capital projects on the Arizona transportation system. While the primary goal of this process is to guide, assess, and prioritize long-range transportation investments, several other important goals were identified by ADOT for incorporation. These included:

- **Building accountability and political support in the planning process by streamlining the management and associated decision-making about the allocation of resources for transportation investments.** Performance-based planning ensures accountability in decision-making, not only from the ADOT technical perspective, but also from the perspective of the Arizona Transportation Board.

- **Providing better, more accurate information to decision-makers with defensible, robust, and consistent analytical tools using system performance outcomes as the basis for identifying transportation investments.** This process provides ADOT and the Arizona Transportation Board with a rigorous technical method that prioritizes projects based on system performance impacts and benefits.

- **Providing a mechanism to monitor and track the success of transportation projects in meeting stated system performance goals and objectives.** Once projects are constructed and operational, this process provides ADOT and its Board with a mechanism to monitor the actual effects of performance on the transportation system. ADOT will then be able to refine and adjust the process to better meet transportation system performance goals.

- **Developing linkages between short- and long-range major capital project investments.** The initial MoveAZ Plan evaluation process provides ADOT with a list of prioritized capital projects that forms the basis of the State's long-range capital program. By 2010, this process will be integrated into both the short-range, Five-Year Capital Program and ADOT's planning to programming (including scoping) process.

- **Refining the methods used by ADOT to allocate resources among programs and capital projects and to potentially assess the tradeoffs of allocating funds by program and project area.** The process provides ADOT an opportunity to conduct tradeoff analysis to better utilize and allocate funds.

The MoveAZ Plan evaluation process involves identifying the expected future performance improvements of projects on the transportation system. The basic components of the process include:

- Identifying performance measures;
- Identifying projects and creating project bundles;
- Calculating system performance;
- Establishing thresholds to evaluate projects;
- Assessing project needs;
- Normalizing performance measures;
- Scoring performance factors; and
- Weighting performance factors.

Because the process was implemented with the understanding that all currently programmed projects (through 2008) would be built, programmed projects were not considered for evaluation. Each component of the MoveAZ Plan evaluation process is presented in the following sections.

4.1 Identifying Performance Measures

Performance measures used to support the MoveAZ Plan were selected to identify and monitor system performance and gauge the ability of proposed projects to satisfy ADOT's goals. These goals can be described by the following performance factors:

- Mobility;
- Economic competitiveness;
- Connectivity;
- Preservation;
- Reliability;
- Safety;
- Accessibility; and
- Resource conservation.

Performance measures were organized according to the performance factors to which they apply (mobility and economic competitiveness were grouped together, as performance measures for those factors apply to both). Performance measures were identified, assessed, and finalized using input from the MoveAZ Steering Committee, MoveAZ

Working Group, and the MoveAZ Performance Measures and Factors input team. The measures are summarized below by performance factor.

Mobility and Economic Competitiveness

Mobility and economic competitiveness are captured by similar measures, because mobility is a key component to the economic well-being of Arizona. As Chapter 8 describes in greater detail, goods movement on the state transportation system is a major component of the State's economy. Providing for mobility will increase the economic competitiveness of the State.

These factors considered two measures:

1. Percent of person-miles traveled (PMT) by level of service (LOS); and
2. Average delay per trip.

Percent of PMT by LOS provides a broad systemwide perspective of how much travel is occurring under congested conditions. It also provides a visual representation of system conditions by different roadways (interstates and arterials) and areas (urban and rural). Average delay per trip measures the additional travel time the average traveler requires to reach a given destination. It measures mobility from the traveler's perspective, rather than from the systemwide perspective.

Connectivity

The following two connectivity measures consider the availability of efficient highway connections between Arizona cities and towns, particularly in more rural areas of the State:

1. Passing ability; and
2. Intercity travel time connectivity.

Passing ability identifies the ability to overtake slower moving vehicles on two-lane state highways. Passing ability is a function of sight distances, roadway grades, traffic volumes, and other related factors. Intercity travel time connectivity evaluates the circuitousness and travel time of existing state routes in the Arizona's high-priority corridors. The evaluation considers assessing the potential for travel time savings in these priority corridors associated with the project improvements.

Preservation

ADOT uses pavement and bridge management systems to determine future pavement and bridge conditions. As pavement and bridge maintenance and construction are

funded separately within ADOT, only the reconstruction need measure was computed in the MoveAZ Plan evaluation process. This measure can be updated by more detailed measures of pavement and bridge conditions as ADOT implements more advanced management systems. The preservation performance measures include:

- Reconstruction need;
- Pavement condition;
- Vehicle miles of travel (VMT) by pavement condition;
- Bridge condition; and
- Vehicle trips by bridge condition.

Reconstruction need assesses roadway segments requiring total reconstruction, with an average year of last reconstruction before 1970. This measure is used in the MoveAZ Plan to evaluate projects that improve deteriorating roadways, but do not affect roadway capacity.

The pavement condition and VMT by pavement condition measures rate the smoothness of state highway lane miles and associated vehicle movements on a scale from zero ("very poor") to five ("excellent"). The bridge condition and vehicle trips by bridge condition measures identify the number or percentage of deficient bridges on state highways and the vehicular movements on those deficient bridges. A seven-point rating is used, with seven being excellent.

Reliability

Additional unexpected delay was examined to understand how incident-related delay (e.g., vehicular-related crashes, spills) and non-recurring delay (e.g., special events) impact vehicle movements and travel times on state roadways.

Safety

The safety performance factor includes two measures:

1. Crashes per million VMT by roadway type; and
2. Anticipated reduction in fatalities and injuries.

Crashes per million VMT identifies the likelihood that crashes will increase as the number of vehicles on Arizona's roads increases. The anticipated reduction in fatalities and injuries identifies specific locations that have a high absolute number of crashes and the types of projects that could be implemented to reduce these crashes.

Accessibility

The following measures were used to examine accessibility by bus, bicycle, and HOV:

- Park-and-ride spaces;
- Bus turnouts; and
- Bike suitability.

The number of park-and-ride spaces helps determine access to the state transportation system for carpoolers and bus riders. The number of bus turnouts on state highways with transit or school bus service determines bus accessibility. Bike suitability considers the percent of state roadways suitable for bike usage based on ADOT definitions of bike suitability in the recently completed Bicycle/Pedestrian Plan. Existing roadways can often be made more suitable for bicycle travel without the need for costly new construction projects.

Resource Conservation

Resource conservation considers the following measures:

- Total mobile source emissions;
- Percentage of air quality improvement projects selected;
- Noise exposure;
- Projects listed in RTPs; and
- Fuel consumption.

Total mobile source emissions gauge systemwide environmental performance, as well as the environmental impact in areas where air quality is already a critical concern. Percentage of selected air quality improvement projects identifies air quality projects designed to reduce mobile source emissions. Noise exposure measures residential area exposure to transportation-related noise. Projects listed in RTPs examine the level of coordination between the MoveAZ Plan and regional plans in order to ensure that transportation decisions (and, indirectly, land-use decisions) are consistent across different tiers of government. Fuel consumption is a function of fleet fuel economy, as well as the specific projects ADOT chooses to build in the future.

4.2 Identifying Projects and Creating Project Bundles

The 1994 ADOT long-range transportation plan identified 33 high-priority corridors for further evaluation. Since that time, ADOT has created at least one profile for each of these

major corridors. These profiles were prepared to analyze the transportation deficiencies and needs of a particular corridor, and to identify projects that could alleviate these deficiencies. ADOT also conducted small area transportation studies that focused on the short- and long-term transportation needs of smaller regions. The corridor profiles and the small area studies were a source of projects for MoveAZ Plan evaluations.

Another source of projects was the Vision 21 Plan, developed by the Governor's Office. Vision 21 included a major effort to identify all transportation needs in the State. The effort identified transportation needs from ADOT's corridor profiles and small area transportation studies, as well as regional and local transportation plans and studies. The resulting database of projects was merged with the projects described above to generate a list of proposed projects for consideration and evaluation in MoveAZ.

Because of its broad geographic scope and 20-year planning horizon, the MoveAZ Plan focuses only on large transportation projects. In contrast, ADOT corridor profiles and other studies cover a variety of both large and small projects. To ensure that the performance impacts of these projects were accurately measured, smaller projects were bundled together with appropriate large and small projects and analyzed in the MoveAZ Plan evaluation process.

As shown in Figure 4.1, ADOT has adopted a set of decision guidelines to bundle projects for evaluation. These guidelines are general rules of thumb intended to allow ADOT the flexibility to design bundles appropriate to the circumstances of a particular district or project type. These decision guidelines were applied to the available ADOT project list generated through corridor profile and other studies to develop the project bundles. These bundles were then reviewed and approved by ADOT planning staff and district engineers prior to full analysis in the MoveAZ Plan evaluation process. Bundles were not prepared in Maricopa County, because the MAG RTP identifies project needs in the MAG area and is incorporated by reference into MoveAZ (see page 3-7).

In addition to bundling projects for evaluation, cost estimates for the individual project elements of each bundle were checked for validity and consistency. Because corridor profiles and other studies were conducted over several years using numerous sources of financial data, there were inconsistencies in the cost estimates. A two-part process was used to develop consistent cost estimates. First, unit costs were estimated for types of projects from ADOT's corridor profiles. Project types included highway widening, interchange construction, bridge replacement, and others. Second, these "typical" unit cost estimates were compared to the original cost estimates in meetings with each of the ADOT district engineers to determine the appropriate cost for a particular project.

Figure 4.1 MoveAZ Plan Project "Bundling" Decision Guidelines

1. Small cost items within a widening project that are not part of a subprogram will be grouped with the widening.

2. Bridge and pavement preservation projects will be analyzed using management systems and not as capital projects.

    a. Exception: If a bridge must be replaced due to a road widening or other project, then it will be included in the project bundles.

3. Short widening segments will be grouped together in a corridor if they are nearly adjacent (less than two miles apart).

4. Interchanges and bridge replacement projects will be grouped with widening (or other projects) whenever they overlap or are very close (within two miles).

    a. Exception: If a corridor study specifies the interchanges or bridges to be altered as part of the widening project, only those interchanges or bridges within the project area will be included.

5. Projects on different roadways that are tightly aligned and have been planned together (according to existing sources) will be grouped as a single project. (Example: Widening projects in downtown Yuma on I-8, B-8, and SR 280.)

6. A group of similar projects that are more than two miles apart may be grouped together if they have been planned to address a single problem. (Example: Climbing lanes that are one to three miles apart.)

7. Total combined project costs will be kept within a reasonable range of about $50 million. This serves as a guide only, not as a rule. For example, three widenings in a corridor at a cost of $40 million each will be treated separately, rather than combined into a single $120 million project.

Source: Cambridge Systematics, Inc., and ADOT, 2003.

4.3 Calculating Project Performance

Fourteen specific system performance measures are shown in Table 4.1. Several measures presented in Section 4.1 could not be calculated to support the MoveAZ Plan evaluation process, because they lacked a natural baseline to measure against. These included bus turnouts, noise barriers, and consistency with regional transportation plans. Some preservation measures, primarily the bridge and pavement conditions measures, were also not used into the evaluation process, because pavement preservation and bridge maintenance work is funded through subprograms that use independent processes to evaluate the

performance benefits of particular projects. Though many of the projects analyzed by MoveAZ have an impact on pavement conditions (e.g., widening a highway over several miles typically includes resurfacing the entire highway over that segment, yielding overall improved pavement conditions), this impact is not captured intentionally. For the remainder of the discussion of performance measures, MoveAZ only addresses the reconstruction need measure. More detail on ADOT's use of subprograms can be found in Chapter 6.

Table 4.1 MoveAZ System Performance Measures

Performance Factor	Performance Measures
Mobility and economic competitiveness	• Improvement in vehicle-to-capacity (V/C) ratio (weighted average by PMT) • Reduction in hours of delay
Connectivity	• Ability to pass in major two-lane corridors • Travel time improvement on ADOT high-priority corridors
Safety	• Improvement in crash rate (crashes per 100 million VMT) • Reduction in injuries
Preservation	• Reconstruction for older roads
Reliability	• Reduction in hours of incident-related delay
Accessibility	• Improvement in bike suitability (from Bicycle/Pedestrian Plan) • Added bus turnouts
Resource conservation	• Reduction in mobile source emissions • Reduction in fuel consumption • Added sound walls • Project consistency with local plans

Source: Cambridge Systematics, 2004.

The measures were calculated at the district level to determine the "district base performance." These base performance values were calculated using the 2025 estimates of travel volumes for a given district. After calculating the district base performance, the performance for the districts was recalculated with the new project bundles to identify system performance impacts. This was referred to as the "district plus project performance scenario." The improvement from the district base performance to the district plus project performance showed the performance gains that resulted from a particular project bundle. This process was repeated for each of the project bundles in each district to calculate the system performance.

4.4 Establishing Thresholds to Evaluate Projects

The performance measures described in Section 4.3 provided a raw assessment of the estimated performance improvement that a given project bundle would produce. The MoveAZ Plan evaluation process also accounted for the "need" of a particular project bundle by applying upper and lower ranges to some performance measures. These threshold value ranges ensured that the transportation system improved by a project bundle included needs analysis. Project bundles above or below a particular threshold were unlikely to show a need for the particular improvement.

Thresholds were used for several of the performance measures to help ensure that the evaluation process captured the need for a given project, in addition to the performance improvement. Not all of the performance measures used thresholds. For example, the reduction in injuries was measured without a threshold, because each additional crash eliminated was as beneficial as the previous. Table 4.2 presents the thresholds used for each measure.

4.5 Assessing Project Needs

A second method was used to account for the "need" of a particular project bundle. For several of the measures, the MoveAZ Plan evaluation process accounted for volume of traffic using the segments of roadway affected by the project. The performance improvement was multiplied by the project bundle average annual daily traffic (AADT) to generate this performance assessment.

There were several exceptions to this process. The delay and incident delay measures, which were calculated as hours of delay saved, were not multiplied by the project bundle AADT. Similarly, the number of injuries reduced by a project was already calculated using the project bundle AADT. Bike suitability, bus turnouts, noise barriers, and regional plan consistency also did not use the project bundle AADT.

Table 4.2 MoveAZ Performance Measure Thresholds

Performance Measure	Threshold
Mobility and Economic Competitiveness	
• Improvement in V/C	Uses existing ADOT standards: 0.71 for rural highway segments and 0.8 for urban highway segments. A segment that is already below the given threshold scores zero points; segments that are improved below the threshold value receive the portion of their improvement to the threshold.
• Reduction in hours of delay	Total delay for a given district in 2002. If a project reduces delay in a given district below the 2002 level, it receives that portion of the improvement down to the 2002 level.
Connectivity	
• Ability to pass in major two-lane corridors	One, the value at which AADT is equal to passing-lane weighted service volume. Improvements that reduce the ratio below one are scored only to this threshold.
• Travel time improvement on ADOT high-priority corridors	The 2002 travel time in the affected corridor. If a project reduces the travel time to below the 2002 level, it only receives that portion of the improvement to the 2002 level.
Safety	
• Improvement in crash rate • Reduction in injuries	No threshold used.
Preservation	
• Reconstruction need	Road last reconstructed before 1970.
Reliability	
• Reduction in hours of incident-related delay	The total incident delay for a given district in 2002. If a project reduces incident delay below the 2002 level, it only receives that portion of the improvement to the 2002 level.
Accessibility Factor	
• Improvement in bike suitability • Added bus turnouts	No threshold used.
Resource Conservation Factor	
• Reduction in mobile source emissions	The distribution of emissions rates is U-shaped, with peaks at low and high speeds. Projects score on this measure only if they reduce emissions.
• Reduction in fuel consumption	The distribution of fuel consumption rates is U-shaped, with peaks at low and high speeds. Projects score on this measure only if they reduce fuel consumption.
• Added sound walls • Project consistency with local plans	No threshold used.

Source: Cambridge Systematics, Inc., 2004.

4.6 Normalizing Performance Measures

To develop consistency in the measures, raw scores on each measure were converted into a normalized score between zero and 10 points. A zero score indicated that a given project bundle did nothing to improve a particular measure. The remaining points were assigned to project bundles relative to the scores of all project bundles analyzed for MoveAZ.

The scores were normalized on a 10-point scale, based on their position in the distribution of all project bundles on that score. This process is referred to as the percent rank. A project bundle with a score that was better than X percent of all project bundles on a given measure received a normalized score of X/10. For example,

- A project bundle that performed better than 80 percent of all other project bundles scored eight points;
- A project bundle that performed better than one-half of other projects scored five points;
- A project bundle that performed better than only 10 percent of other projects scored a single point; and
- A project bundle that provided no performance improvement scored zero point.

This method was applied to reduce the influence of outliers on the scoring method. If one or two projects performed much better on a given measure than all other projects, they would not skew the scale. For example, if the third best project scored better than 92 percent of all projects, it received 9.2 points, even if the performance score for the top two projects were substantially larger (i.e., double or greater) than the third best project.

4.7 Scoring Performance Factors

Project bundles received a final score on each performance factor as a function of their score on one or more performance measures. Similar to the measures, each of the performance factors was also scored on a 10-point scale. The reliability factor had only one measure, so the factor score was the same as the measure score. For all other factors, multiple measures contributed to the factor score. For most factors, the final score was the average of the measures making up that score, with some exceptions. Table 4.3 describes the procedure for combining each set of measures into a single factor score.

Table 4.3 Performance Factor Scoring Methodology

Performance Factor	Measure Methodology
Mobility and economic competitiveness	Average of the two measures
Connectivity	Average of the two measures
Safety	Average of the two measures
Preservation	Single measure
Reliability	Single measure
Accessibility	Score of bike suitability measure, plus a single point for any added bus turnouts; maximum of 10 points
Resource conservation	Average of emissions and fuel consumption measures, plus a point each for a project with sound walls or a project that is consistent with local plans; maximum of 10 points

Source: Cambridge Systematics, Inc., 2004.

4.8 Weighting Performance Factors

The final step in the MoveAZ Plan evaluation process was the application of performance weights to each of the factor scores to generate a total score for each project bundle. Weights provided a means to formalize the priorities of the long-range goals and performance factors of MoveAZ. The legislation directing ADOT to develop a long-range plan (House Bill 2660) also required a system of weights to be applied to the performance factors. A system of weights for each of the seven performance factors used in project analysis was developed through public and stakeholder involvement for the plan in coordination with existing ADOT policies and technical concerns.

Weighting Methodology

A three-step process was used to develop performance factor weights:

1. First, performance factors were identified;

2. Second, each factor received one of three descriptive weights that represented the relative priority assigned to that factor; and

3. Finally, each of the descriptive weights was assigned specific quantitative values that were then applied to the factor scores resulting from the evaluation process.

Three descriptive weights were selected to describe the relative priorities of the factors:

1. **Enhance** was used for factors with the highest priority for ADOT. These are factors that ADOT should focus on to improve roadway performance, possibly at the expense of other factors.

2. **Sustain** was used for factors for which ADOT should try to maintain current performance levels.

3. **Neutral** was used for all other factors. These factors represent issues that are important, but somewhat less so than other factors.

During the evaluation process, the descriptive weight categories were translated into numerical weights. The final weights were subject to extensive sensitivity testing during the planning process.

Sources for Weights

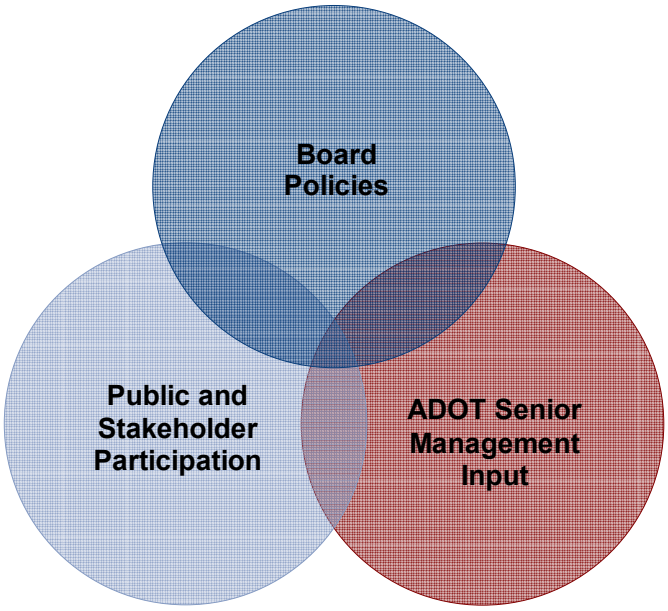
The major sources used to develop the performance factor weights are described below and shown in Figure 4.2:

- **Currently adopted board policies.** The Arizona Transportation Board policy document describes the current vision and commitments that the Board makes for transportation in Arizona. It also outlines a set of policies to help meet these commitments.

- **Public input conducted as part of the MoveAZ planning process.** MoveAZ included three phases of public and stakeholder involvement. Through focus groups and regional forums, members of the public were able to help shape the MoveAZ strategic direction. MoveAZ included an analysis of comments made at all of these public events, as well as through previous planning processes.

- **Consistency with departmental goals.** The MoveAZ Continuity Team is an internal ADOT committee consisting of representatives of ADOT's major divisions. This group provided guidance on the selection of weights to ensure that the weights fit with existing departmental goals.

Figure 4.2 Sources of MoveAZ Factor Weights



MoveAZ Descriptive Weights

Overall, each of the performance factors received support at all of the regional public forums and in the Arizona Transportation Board policy statement. During the intermediate partnering phase of the MoveAZ Plan, participants were asked to select the most important key findings from the initial phase. Across all of the forums, each of the key findings received nearly the same level of support.

Enhance

- **Mobility and economic competitiveness** is one of the primary goals of both ADOT and the traveling public. Consultation with ADOT staff and public partnering events revealed that mobility is consistently a high-priority issue. For example, participants at the regional public forums cited concerns and strategies related to mobility more frequently than all other performance factors during both the initial and intermediate partnering events.

- **Safety** is extremely important to ADOT, various Federal agencies, and the traveling public. ADOT is committed to reducing crashes involving motor vehicles and making the roads safer for all users. In public partnering sessions, safety was consistently raised as an issue. For these reasons, safety received an enhance rating.

Sustain

- **Accessibility** or providing access to the transportation system for users is an important goal for ADOT. This goal received relatively strong support during the public partnering events. It was also consistent with ADOT policy to develop a multimodal transportation system that provides opportunities for all Arizonans to use the transportation system.

- **Preservation** or investing in the maintenance of the transportation system is important to ADOT and Arizonans alike. Pavement condition in Arizona is substantially better than for the U.S. as a whole. This commitment to preservation was supported by participants at public partnering events. Because the quality of maintenance is already quite high, this factor receives a sustain, instead of an enhance.

Neutral

- **Resource conservation**, as with all of the other factors, is an important goal for ADOT. Compared to some of the issues raised by other factors, however, resource conservation is somewhat less important. Providing for travel mobility and improving roadway safety form the core of ADOT policy. Similarly, public partnering sessions were less likely to point to resource conservation issues. For these reasons, the resource conservation factor receives a neutral rating.

- **Reliability** taps the public's desire for predictability of travel. As a growing state with a rapidly growing transportation system, reliability concerns are somewhat less important than overall mobility. As the Arizona transportation system matures, however, reliability concerns will likely grow. For the MoveAZ Plan, reliability received a neutral rating.

- **Connectivity** is a goal supported by ADOT and at the MoveAZ public partnering sessions. Again, however, it received overall less support than other related issues. Connectivity is closely related to other issues, such as mobility and accessibility. But where these issues received substantial public support, the support for connectivity was much more varied. Connectivity received relatively less support across all of the forums, compared to other performance factors. This strategy, therefore, was weighted as neutral, because it is important, but not more so than other strategies.

MoveAZ Numeric Weights

The final set of weights developed for the MoveAZ performance factors was based on consultations with the ADOT advisory bodies and detailed sensitivity analyses. The objective of using weights in the evaluation process was to provide additional support to projects that perform well on higher-priority factors, such as safety and mobility. However, ADOT recognized that each performance factor is important for the transportation system. Weights were not intended to cause a radical redistribution of performance to

projects. As a result, the weights shown in Table 4.4 provide a moderate boost to project bundles that improve mobility, safety, accessibility, and preservation.

Table 4.4 Performance Factors Weights

Performance Factor	Weight
Mobility	1.4
Reliability	1.0
Connectivity	1.0
Accessibility	1.2
Safety	1.4
Preservation	1.2
Resource Conservation	1.0

Source: Cambridge Systematics, Inc., 2004.

5. Base and Future System Performance

Chapter 5. Base and Future System Performance

Performance of the state transportation system was quantified using the factors and measures described in Section 4.0. These measures establish the existing (year 2002) and future 2025 "base-line" conditions on state roadways. This analysis was conducted prior to evaluation and analysis of specific project bundles for the MoveAZ Plan evaluation process.

Both existing (2002) projects and financially committed projects (specified by ADOT) to be constructed by 2025 were considered. As shown in Table 5.1, several of the roadway performance measures were not applied to identify base and future performance. Some were omitted because of a lack of data; others because they were useful for comparative purposes only; and still others because they focused on the programming process, rather than project analysis.

Table 5.1 Measures Not Used in System Performance Analysis

Performance Measure	No System Performance Calculations		Reasons for Not Including These Measures in Systems Analysis
	2002	2025	
Reconstruction need	●	●	Relevant only for project comparison (interim measure)
Pavement condition		●	Separate programming area
VMT by pavement condition		●	Separate programming area
Bridge condition	●	●	Separate programming area
Vehicle trips by bridge condition	●	●	Separate programming area
Park-and-ride spaces	●	●	Data unavailable
Bus turnouts	●	●	Data unavailable
Percentage of air quality improvement projects selected	●	●	Relevant only for project comparison
Noise exposure	●	●	Data unavailable
Projects listed in RTPs	●	●	Relevant only for project comparison

Results of the existing and future year system performance analysis are presented below by factor for the state highway system only. This analysis was used as a benchmark for evaluating the performance benefits of each project bundle analyzed in the MoveAZ Plan evaluation process, as presented in Chapter 4.

5.1 Mobility and Economic Competitiveness

Percent of Person-Miles of Travel by Level of Service

This measure considers the percentage of PMT that occur at acceptable levels of congestion. Congestion is measured on the highway system using a LOS grading system. Roadway segments with LOS A have substantial excess capacity. Segments with LOS F are gridlocked. ADOT has defined acceptable congestion in Arizona as LOS C or better in rural areas, and LOS D or better in urban areas. As shown in Table 5.2, this measure predicts that, statewide, Arizonans will be half as likely to find acceptable congestion levels on state routes in 2025 as in 2002. PMT under congested conditions are projected to nearly double in the Tucson district and to more than double in the Safford, Phoenix, and Prescott districts. In the Yuma, Holbrook, Kingman, and Flagstaff districts, which currently experience a very low percentage of total PMT at unacceptable congestion levels, the proportion of travel in unacceptable congested conditions is projected to increase by tenfold or more.

Table 5.2 Percent of PMT by LOS and District

	% PMT at LOS A-C Rural, LOS A-D Urban	
District	**2002**	**2025**
Flagstaff	97	54
Globe	84	79
Holbrook	100	82
Kingman	98	59
Phoenix	64	20
Prescott	73	40
Safford	93	68
Tucson	68	38
Yuma	100	39
State Total	**77**	**38**

Source: Cambridge Systematics, Inc., October 2003.

Average Delay Per Trip

As shown in Table 5.3, motorists will see the length of their average delay rise six fold between 2002 and 2025, from about one minute to seven minutes per trip. While the Phoenix district contributes significantly to the overall increase in roadway delay, other urban and rural districts also are expected to show significant increases in average delay. For example, the residents of the Yuma, Prescott, and Kingman districts will experience trip delays of about two additional minutes per motor vehicle trip.

Table 5.3 Average Delay Per Vehicle Trip by District

	Average Delay Per Trip (Hours:Minutes)	
District	**2002**	**2025**
Flagstaff	0:56	1:40
Globe	0:44	1:34
Holbrook	0:15	0:27
Kingman	0:35	2:39
Phoenix	1:56	9:16
Prescott	0:43	2:29
Safford	0:27	1:08
Tucson	0:37	3:16
Yuma	0:54	2:49
State Total	1:17	6:58

Source: Cambridge Systematics, Inc., October 2003.

5.2 Connectivity

Ability to Overtake in Major Two-Lane Corridors

The ability to pass is measured as the ratio of the existing or projected traffic volume (AADT) to the passing service volume. The passing service volume is calculated as a function of terrain, curves, percent of vehicles that are heavy trucks, and other factors. A value of 1.0 respresents a traffic volume that is equal to the passing service volume. In most cases, it should be possible to pass other vehicles in a reasonable amount of time at this level. A value of 1.5 indicates that there are 50 percent more vehicles than in the acceptable passing situation.

As shown in Table 5.4, most two-lane state roadways are currently operating at acceptable levels of passing ability, without substantial need for additional passing lanes. However, the analysis predicts that, by 2025, most districts across the State will be approaching values at which passing on a two-lane segment becomes undesirably difficult. The state average passing ability measure will be 1.23 by 2025, indicating that almost 25 percent more vehicles are using roadways than can be accommodated with easy passing. Though all districts across Arizona will suffer, rural areas in districts such as Prescott, Globe, and Flagstaff will be particularly impacted relative to existing conditions.

Table 5.4 Passing Ability by District (Ratio of AADT to Passing Service Volume)

District	2002	2025
Flagstaff	1.01	1.51
Globe	1.23	1.51
Holbrook	0.59	0.74
Kingman	1.06	1.25
Phoenix	0.39	1.11
Prescott	1.26	1.81
Safford	0.63	0.88
Tucson	0.64	1.35
Yuma	0.38	0.87
State Total	**0.82**	**1.23**

Source: Cambridge Systematics, Inc., October 2003.

Intercity Travel Time Connectivity

As shown in Table 5.5, driving time in important travel corridors across Arizona is expected to increase an average of 32 percent between 2002 and 2025. Driving times in the Phoenix to Hoover Dam, Phoenix to Lukeville, Phoenix to Mogollon Rim, and Prescott to Cordes Junction corridors will increase even more; an indication that traffic volumes in these corridors will reach or exceed roadway capacities. For example, travel time is projected to increase 68 percent in the Prescott to Cordes Junction corridor, and 82 percent in the Phoenix to Hoover Dam corridor.

Table 5.5 Intercity Travel Time by Corridor

Corridor	2002	2025
Douglas – Benson	2:10	2:30
Phoenix – Hoover Dam (Nevada State Line)	4:50	8:00
Flagstaff – Page (Utah State Line)	2:30	2:30
Phoenix – Globe	1:00	1:00
Phoenix – Lukeville	2:30	4:40
Phoenix – Mogollon Rim (Show Low)	3:20	4:50
Prescott – Cordes Junction	0:50	1:20
Yuma – Bullhead City	3:50	4:00
Tucson – Holbrook	4:30	4:50

Source: Cambridge Systematics, Inc., October 2003.

5.3 Preservation

ADOT uses pavement and bridge management systems to evaluate pavement and bridge conditions and identify projects to maintain these conditions at levels established by the Transportation Board. These management systems provide a very detailed form of performance measurement for particular types of projects. Because the MoveAZ plan only evaluates major capital projects, most of the pavement and bridge measures are not calculated here. The only measure used by MoveAZ in the project evaluation is the "reconstruction need" measure. Currently, however, reconstruction need was used to support the project bundle evaluations only, not to assess base and future roadway performance. Base and future year performance for the reconstruction need measure is not relevant at an aggregate district level, but is relevant at the project level.

5.4 Reliability

Unexpected delay that does not recur on a daily basis at predictable times and locations is a major detriment to reliability and predictability. Additional unexpected motorist delay, caused by events such as crashes and other more or less random events, is expected to nearly quadruple between 2002 and 2025, from less than one hour per 1,000 VMT to over three hours per 1,000 VMT (Table 5.6). This equates to almost 450,000 hours of unexpected delay per day in 2025.

Table 5.6 Unexpected Delay by District (Hours Per 1,000 VMT)

District	2002	2025
Flagstaff	0.62	0.53
Globe	0.06	0.06
Holbrook	0.04	0.20
Kingman	0.07	2.15
Phoenix	2.01	6.07
Prescott	0.20	1.25
Safford	0.07	0.22
Tucson	0.46	2.55
Yuma	0.12	2.57
State Total	**0.81**	**3.19**

Source: Cambridge Systematics, Inc., October 2003.

In the Globe district, unexpected delay is not projected to increase; and in the Flagstaff district, it is expected to decline slightly. In all other Arizona districts, however, unexpected delay will increase significantly over the next two decades. The Yuma and Kingman districts are projected to have the most significant percent increase in unexpected delays, which will rise by about 15 minutes and 10 minutes per 1,000 VMT, respectively. The Tucson, Prescott, and Holbrook districts will all see five-fold increases in unexpected delay. In the Phoenix district, unexpected delays are projected to increase at a somewhat slower pace, but Phoenix's overall level of unexpected delay – about two hours in 2002 and about six hours in 2025 per 1,000 VMT – is by far the highest in the State.

5.5 Safety

Crashes Per 100 Million VMT

Crash rates distinguish between those involving injuries, fatalities, or only property damage. Crash rates in Arizona are projected to change over time as a result of factors such as changing average vehicle speeds, or improvements to the highway facilities (e.g., improved from two-lane undivided to a four-lane divided highway.) As shown in Table 5.7, the number of motor vehicle crashes involving injuries per 100 million VMT is projected to decrease slightly between 2002 and 2025, statewide. Some individual districts' crash and injury rates will increase, while others will decrease. However, every

district's fatality rate is expected to stay the same or increase slightly by 2025. Crash and injury rates in the Kingman and Prescott districts are projected to increase by over 10 percent, the most significant increase of any district. In contrast, crash and injury rates in the Yuma district are projected to decline by almost 20 percent, though the fatality rate is still expected to increase by 10 percent.

In the Holbrook district, overall crash rates are relatively low, but fatality rates are the highest in Arizona; three in every 100 crashes involving motor vehicles in Holbrook involve a fatality, a number that is not projected to change by 2025. Both the Tucson and Phoenix districts have the lowest number of fatalities as a percent of total crashes, with less than one fatality-related crash per 200 crashes involving motor vehicles in both 2002 and 2025. In the Yuma district, nearly 30 of every 100 crashes involve an injury, the highest number of injuries as a percent of total crashes for both 2002 and 2025. In the Flagstaff district, however, only 21 of every 100 crashes involve an injury.

Table 5.7 Crashes Per 100 Million VMT by District

	2002			2025		
District	**Crash**	**Injury**	**Fatality**	**Crash**	**Injury**	**Fatality**
Flagstaff	165.0	44.5	1.9	172.9	46.8	2.1
Globe	151.6	54.6	3.2	148.1	60.7	3.5
Holbrook	56.0	20.0	2.4	59.3	19.4	2.4
Kingman	132.4	45.9	2.3	149.5	51.7	2.3
Phoenix	761.6	287.3	3.5	776.9	292.7	3.6
Prescott	154.3	51.7	2.2	171.0	58.3	2.3
Safford	132.9	43.5	2.3	137.0	47.0	2.4
Tucson	472.5	184.2	3.1	469.2	183.2	3.2
Yuma	132.6	55.1	3.0	106.2	46.1	3.3
State Total	**421.0**	**157.1**	**2.9**	**415.7**	**155.8**	**3.1**

Source: Cambridge Systematics, Inc., October 2003.

Anticipated Change in Injuries/Fatalities

Even in cases where injury rates remain constant or decrease between 2002 and 2025, the total *number* of annual injuries and fatalities is projected to increase due to the overall rise in VMT. This trend is shown in Table 5.8. In percentage terms, most districts will see the number of motor vehicle-related injuries and fatalities double. The Yuma and Prescott districts will see the largest increases in percentage terms: 228 percent and 138 percent, respectively, for injuries; and 333 percent and 121 percent, respectively, for fatalities. In absolute terms, the Phoenix district will see the largest increase in injuries and fatalities,

with 26,000 additional annual motor vehicle-related injuries and 330 additional annual motor vehicle-related fatalities projected to occur there in 2025. The Phoenix and Tucson districts have – and will continue to have in 2025 – the highest VMT in the State and the highest numbers of annual injuries and fatalities related to motor vehicles. Currently, the Flagstaff district has the third highest number of annual injuries (almost 1,000) in 2002, but will be surpassed by the Yuma district by 2025 as a result of the latter's projected three-fold increase in injuries. The Globe district has the fewest number of fatalities and the Holbrook district has the fewest injuries, both now and in the future.

Table 5.8 Anticipated Change in Injuries/Fatalities by District

	2002-2025 Change in Injuries		2002-2025 Change in Fatalities	
District	**Absolute Change**	**Percent Change**	**Absolute Change**	**Percent Change**
Flagstaff	911	94%	40	95%
Globe	404	83%	23	81%
Holbrook	230	80%	30	89%
Kingman	1,039	139%	41	108%
Phoenix	26,367	107%	330	110%
Prescott	1,262	138%	48	121%
Safford	617	103%	31	99%
Tucson	7,400	109%	134	118%
Yuma	1,894	228%	150	333%
State Total	**40,124**	**111%**	**827**	**123%**

Source: Cambridge Systematics, Inc., October 2003.

5.6 Accessibility

Table 5.9 shows the percentage of state roadway miles estimated to be moderately and highly suitable for bicycling in 2002 and 2025. Increasing traffic volumes will cause the percentage of state roads estimated highly bike suitable to decrease from 23 percent to 14 percent, and the percentage estimated moderately suitable to decrease from 56 percent to 48 percent. Bike suitability is projected to decline the fastest in percentage terms in the Kingman and Tucson districts. In Kingman, the percentage of state roads highly suitable and moderately suitable for cycling will fall from 10 percent to five percent and from 71 percent to 45 percent, respectively. In the Globe, Phoenix, and Prescott districts, the

percentage of state roads moderately suitable will grow slightly as conditions worsen on roads currently estimated highly suitable.

Table 5.9 Percent of State Road Miles Moderately/Highly Bike Suitable by District

District	2002		2025	
	Percentage of State Road Miles Moderately Bike Suitable	Percentage of State Road Miles Highly Bike Suitable	Percentage of State Road Miles Moderately Bike Suitable	Percentage of State Road Miles Highly Bike Suitable
Flagstaff	59%	24%	48%	14%
Globe	50%	30%	52%	21%
Holbrook	63%	22%	49%	15%
Kingman	71%	10%	45%	5%
Phoenix	58%	19%	61%	12%
Prescott	49%	21%	50%	15%
Safford	56%	35%	56%	23%
Tucson	52%	9%	37%	4%
Yuma	49%	28%	41%	16%
State Total	**56%**	**23%**	**48%**	**14%**

Source: Cambridge Systematics, Inc., October 2003.

The Safford district has – and is projected to have in 2025 – the greatest percentage of bike suitable state roads. Combined, the percentage of roads estimated to be highly and moderately suitable was 91 percent in 2002 and will fall only slightly to 79 percent in 2025. The Tucson district has and is projected to have the lowest percentage of bike suitable state roads: 61 percent highly and moderately suitable in 2002, and 41 percent highly and moderately suitable in 2025.

5.7 Resource Conservation

Total Mobile Source Emissions

As shown in Table 5.10, vehicle emissions due to travel on the state roadway system in Arizona are projected to increase by 67 percent between 2002 and 2025. Mobile source

emissions in the Phoenix and Yuma districts are expected to grow the fastest over this period by 123 percent in Phoenix and 129 percent in Yuma. Arizona's remaining districts will also show increases in transportation-related emissions ranging from 10 to 65 percent, with Prescott showing the highest increase within the range.

Table 5.10 Total Mobile Source Emissions by District (Metric Tons)

District	2002	2025
Flagstaff	83	91
Globe	25	34
Holbrook	55	68
Kingman	60	73
Phoenix	251	560
Prescott	60	99
Safford	50	55
Tucson	131	181
Yuma	56	128
State Total	**771**	**1,288**

Note: This includes emissions from travel on the state road system.
Source: Cambridge Systematics, Inc., October 2003.

The Phoenix and Tucson districts account for about one-half of all mobile source emissions on the state transportation system in Arizona, both currently and in 2025. The Yuma district, while responsible for only a moderate amount of mobile source emissions compared to other districts (56 tons in 2002), is expected to have the third highest emissions of all Arizona districts in 2025 (128 tons) due to its high projected increase in VMT.

Fuel Consumption

As shown in Table 5.11, fuel consumption due to travel on state roads is projected to increase by 176 percent between 2002 and 2025, from over four million gallons to about 12 million gallons of gasoline each day. Although VMT on the state highway system is projected to increase at only one-half this rate between 2002 and 2025, measures such as "percent PMT by LOS" and "average delay per trip" indicate that motor vehicle congestion and delay are increasing substantially, and average travel speed will decline. This causes vehicles to consume more fuel per mile traveled in 2025 than they did in 2002, on average.

Table 5.11 Daily Fuel Consumption by District (Gallons)

District	2002	2025	Percent Change
Flagstaff	436,235	846,999	94%
Globe	155,092	242,377	56%
Holbrook	276,347	617,528	123%
Kingman	309,992	767,568	148%
Phoenix	1,555,214	5,090,310	227%
Prescott	327,844	765,393	133%
Safford	259,819	555,306	114%
Tucson	695,671	1,697,151	144%
Yuma	288,042	1,305,129	353%
State Total	**4,304,257**	**11,887,762**	**176%**

Source: Cambridge Systematics, Inc., October 2003.

Fuel consumption is projected to double in most districts, and more than triple in the Yuma district. Only the Globe and Flagstaff districts will see fuel consumption increases of less than 100 percent.

6. Project Evaluations

Chapter 6. Project Evaluations

This chapter describes the funding scenarios and the results of the MoveAZ performance analysis. As described in Chapter 5, individual projects were packaged into corridor-level bundles for evaluation in the MoveAZ plan. Using base and future year system performance results as a benchmark, the MoveAZ Plan evaluated the benefits of each project bundle on future year system performance, reported by each performance measure and factor. Bundles were then packaged into funding scenarios based on the ADOT estimates of available funding and the total performance score received by a bundle.

6.1 Funding

The MoveAZ performance evaluation process begins with an examination of the total funding available to construct major state transportation projects. Identifying available funding sets the ultimate constraint on the projects identified in MoveAZ. This section describes the process used to estimate funding available for major projects over the course of the plan from 2010 through 2025. The plan begins in 2010 to accommodate ADOT's existing funding commitments to specific projects that are described in the *Five-Year Transportation Facilities Construction Program* (five-year program).

The five-year program is a list of capital transportation projects for which ADOT has identified funding. This program is generated through the coordinated efforts of several ADOT divisions and adopted by the Arizona Transportation Board each year. Each year, new projects are added to the fifth year of the five-year program. The next program cycle, 2006 to 2010, will include projects analyzed in MoveAZ. The process of transitioning from MoveAZ to the five-year programming process is described in more detail in Chapter 9.

To estimate the available funding for projects, three funding scenarios for three funding regions were evaluated. Funding levels were also estimated separately for subprograms and major projects in each region, in accordance with existing ADOT programming practice.

Funding Scenarios

The MoveAZ Plan used three investment scenarios based upon estimates of state and Federal funds available to Arizona, as determined by ADOT Financial Management Services. The three scenarios were:

1. **Constrained –** A projection of currently available funding sources through 2025;

2. **Reasonably anticipated revenues –** An increase above the constrained scenario based on a reasonable increase in revenues that could be derived from Federal and/or state sources; and

3. **Unconstrained –** No financial constraints, including all projects that address specific needs on the state highway transportation system, as identified in previous planning processes.

The constrained scenario represented funding that will likely be available to the State for future programming through 2025. The reasonably anticipated revenues provide a means to describe the additional performance gains that could be derived from a modest increase in transportation funding. Table 6.1 shows total funding available in each of these two scenarios.

Table 6.1 Available Funding for MoveAZ by Scenario

Scenario	Funding ($M 2004)
Constrained	$8,975
Reasonably Anticipated Revenues	$10,958
Potential Increase in Funding	**$1,983**

Source: Arizona Department of Transportation, 2004.

Funding Regions

MoveAZ follows current Board policy by dividing funding and conducting performance analysis independently for three major regions of the State: 1) Maricopa County, 2) Pima County, and 3) the 13 other counties. Maricopa County receives 37 percent of state funding, Pima receives 13 percent, and the 13 other counties receive 50 percent. MoveAZ used this existing funding split to determine the level of funding for each region through 2025.

Subprogram and Major Project Funding

The final step for identifying funding available for project bundles involves estimating the split between subprogram and major project funding. ADOT funds many transportation improvements through subprograms that address key functional areas, such as pavement and bridge maintenance, safety, district-identified minor projects, and others. These sub-programs are funded as a whole, with the relevant projects identified by individual

subprogram managers and analyzed using subprogram-specific tools and performance measures. For example, the ADOT pavement management system identifies roadway segments that require repaving and estimates the cost to maintain a particular pavement condition standard.

The Arizona Transportation Board sets the level of funding available to each subprogram. In recent years, these funding levels have been fairly stable. For the purpose of the MoveAZ Plan, the total funding available for subprograms was assumed to be constant each year and consistent with established funding levels. Table 6.2 shows funding for subprograms for each of the three major regions.

Table 6.2 Annual Funding for Subprograms by Region

County	Yearly Funding ($M)
Maricopa	$30.5
Pima	$18.5
13 Other Counties	$171.0
Total	**$220.0**

Source: Arizona Department of Transportation, 2004.

The total funding available for major projects for each region from 2010 to 2025 was derived by estimating total funding, allocating it among the three major regions using the regional distribution described above, and subtracting total subprogram funding in each region over the same period. The total major project funding identified using this process is shown in Table 6.3.

Table 6.3 Total Funding for Major Projects and Subprograms by Region, 2010-2025 (Constrained Scenario)

County	Funding for Major Projects ($M)	Funding for Subprograms ($M)	Total ($M)
Maricopa	2,832.7	488.0	**3,320.7**
Pima	870.7	296.0	**1,166.7**
13 Other Counties	1,751.7	2,736.0	**4,487.7**
Total	**5,455.1**	**3,520.0**	**8,975.1**

Source: Arizona Department of Transportation, 2004.

6.2 Project Performance Results

MoveAZ project bundles were evaluated on the seven performance factors described in Chapter 4. Projects were evaluated separately for Pima County and the 13 other counties to be consistent with the separate funding streams identified for each region. The plan does not include an evaluation of projects for Maricopa County. These projects are identified as part of the State Transportation Board adopted by MAG RTP. The results of the MoveAZ analysis, as well as the projects identified in the MAG RTP, are organized here by the three funding scenarios described above.

Constrained Revenue Scenario

The constrained revenue scenario presents projects that performed the best in the analysis process. Table 6.4 presents the projects in this scenario for each of the regions. Except for Maricopa County, these projects were analyzed using MoveAZ performance measures and factors. Maricopa projects were analyzed as part of MAG RTP and not using the MoveAZ process. The locations of the constrained scenario projects in Pima County and the 13 other counties are shown in Figure 6.1. Planned state highway improvements for Maricopa County are shown in Figure 6.2.

Table 6.4 MoveAZ Plan Projects – Constrained Scenario

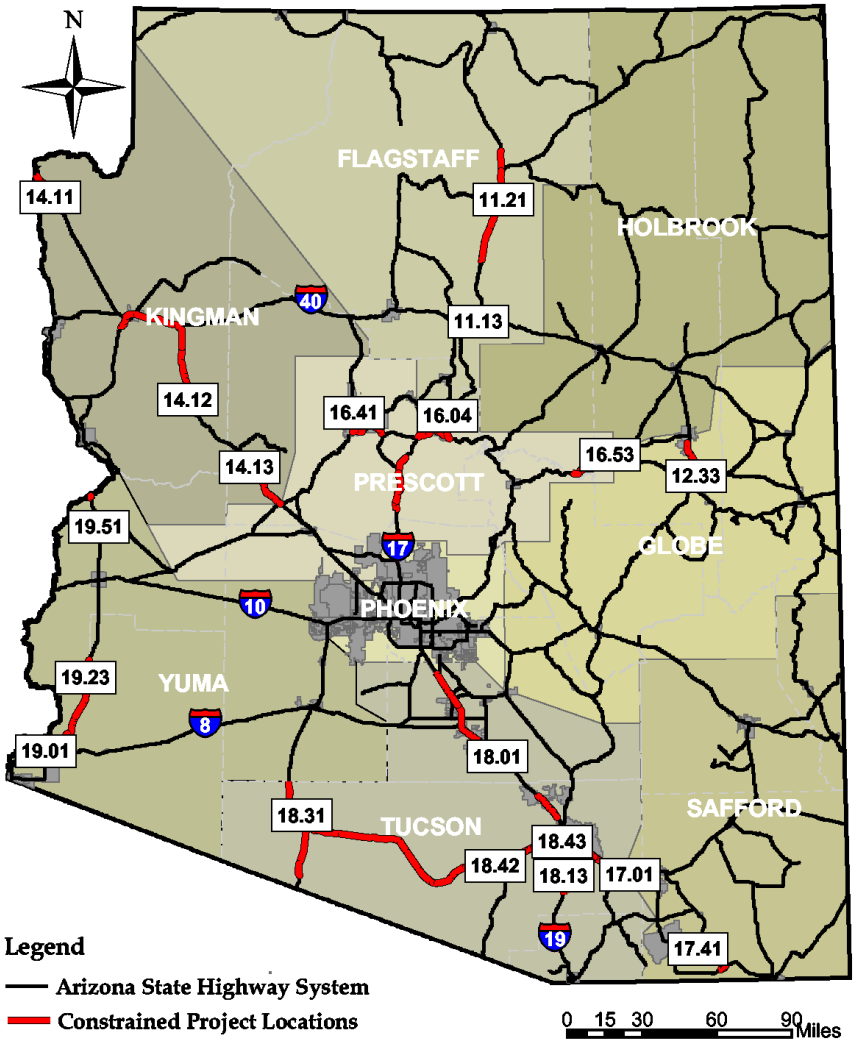
Project	Road	BMP	EMP	Description	Score	Cost ($M)
Projects in Pima County						
18.02	I-10	240	252	Widen roadway to 8 lanes, construct interchanges	38	$159
18.04	I-10	262	275	Widen roadway to 6 lanes	24	$43
18.43	SR 86	150	171	Widen roadway to 4 lanes (10 miles) and 6 lanes (11 miles)	21	$22
18.13	I-19	63	91	Widen roadway to 6 lanes (16 miles), add auxiliary lanes (12 miles)	19	$300
18.03	I-10	275	288	Widen roadway to 6 lanes, reconstruct bridge	19	$36
17.01	I-10	288	303	Widen roadway to 6 lanes	18	$23
18.42	SR 86	92	141	Reconstruction roadway to standards	16	$61
18.41	SR 86	52	92	Reconstruct roadway to standards	15	$122
18.31	SR 85	32	80	Reconstruct roadway to standards	12	$86

Table 6.4 MoveAZ Plan Projects – Constrained Scenario (continued)

Project	Road	BMP	EMP	Description	Score	Cost ($M)
Projects in the 13 Other Counties						
16.21	SR 69	281	296	Widen to 6 lanes	47	$49
14.02	I-40	44	45	Widen to 6 lanes, reconstruct or improve 3 interchanges, noise barriers	42	$142
14.11	U.S. 93	2	17	Widen to 4 lanes	36	$47
17.51	SR 92, SR 90	321	325	Widen to 6 lanes, raised median	36	$14
14.12	U.S. 93	92	121	Reconstruct as a 4-lane divided roadway, new interchanges	36	$250
19.23	U.S. 95	31	70	Widen to 4 lanes, replace bridge	35	$117
14.13	US 93	161	182	Reconstruct as a 4-lane divided roadway	33	$85
14.03	I-40	55	71	Widen to 6 lanes, reconstruct two interchanges	32	$107
16.51	SR 260	208	228	Widen to 4 lanes, raised median (14 miles), reconstruct (6 miles)	31	$122
16.41	SR 89	314	330	Widen to 4 lanes, some segments with turn lanes	31	$44
17.52	SR 92	352	354	Widen to 4 lanes, some segments with turn lanes	30	$6
11.13	I-40	195	205	Reconstruct roadway, widen some segments to 6 lane, noise barriers	30	$41
16.04	I-17	286	298	Widen to 6 lanes	28	$82
18.01	I-10	175	226	Widen to 6 lanes	28	$163
16.03	I-17	278	286	Widen to 8 lanes	26	$80
17.41	SR 90	322	336	Widen to 4 lanes, some segments with turn lanes	26	$45
12.33	SR 77	342	358	Widen to 4 lanes, implement Rural ITS system	26	$51
19.51	SR 95	131	147	Construct passing lane segments, widen a one-mile segment to 6 lanes	25	$7
16.53	SR 260	282	302	Reconstruct roadway, widen a 5-mile segment to 4 lanes	25	$104
16.02	I-17	244	262	Widen to 6 lanes, implement ITS system	22	$61
11.21	U.S. 89	442	482	Widen to 4 lanes, raised median, 3 new interchanges, some segments with turn lanes	21	$130
19.01	I-8	2	12	Widen to 6 lanes, reconstruct interchanges and bridges	21	$55

Note: Projects in Maricopa County include projects funded from both state and regional sources.

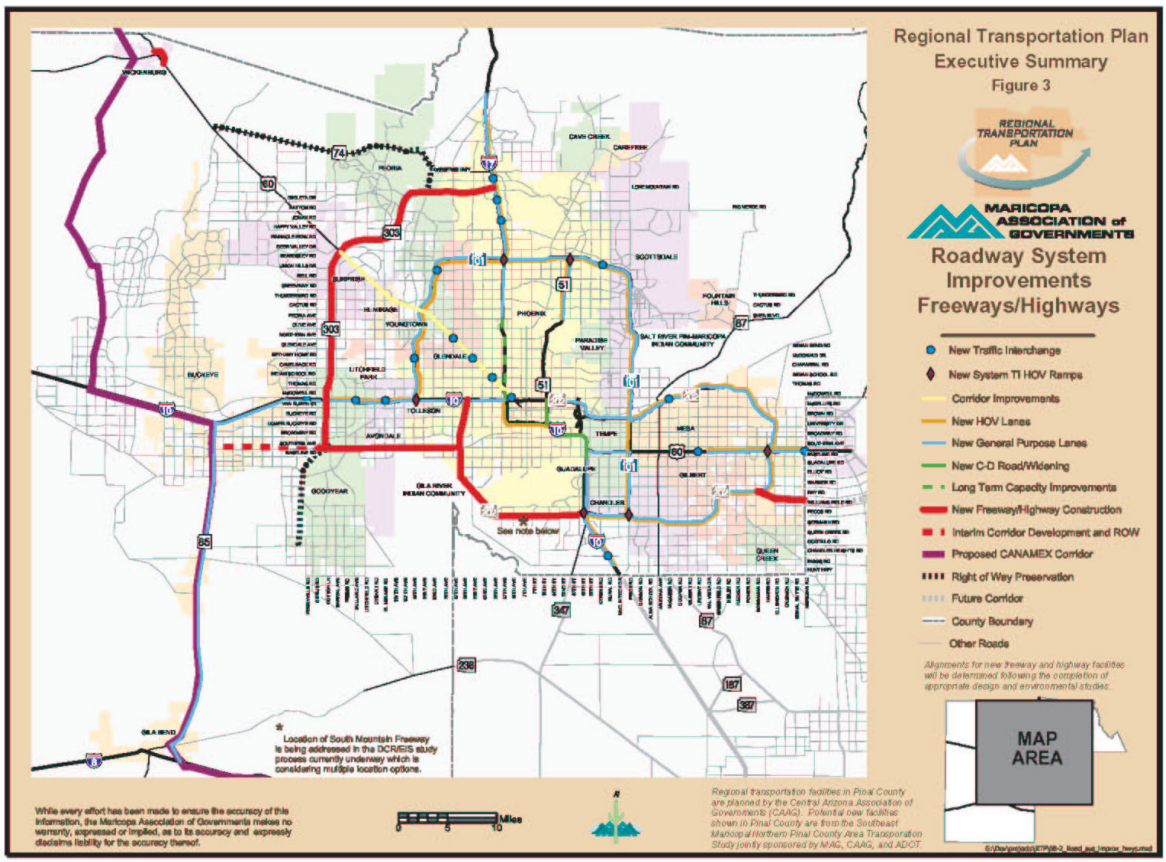
Figure 6.1 Constrained Scenario Project Locations (Pima County and the 13 Other Counties)



Additional Expected Revenues

The second scenario examines the additional projects that might be built if ADOT were to identify new state or Federal funding sources. This scenario was estimated at roughly $2 billion in additional funding. This funding was split between major projects and sub-programs, as described in Section 6.1. Table 6.5 shows the additional funding that would be available to each region in this scenario.

Figure 6.2 Constrained Scenario Project Locations (Maricopa County)



Source: Adapted from Maricopa Association of Governments' Regional Transportation Plan, 2003. Includes projects funded from Federal, state, and regional sources.

Table 6.5 Total Funding for Major Projects and Subprograms by Region, 2010-2025 (Additional Revenue Scenario)

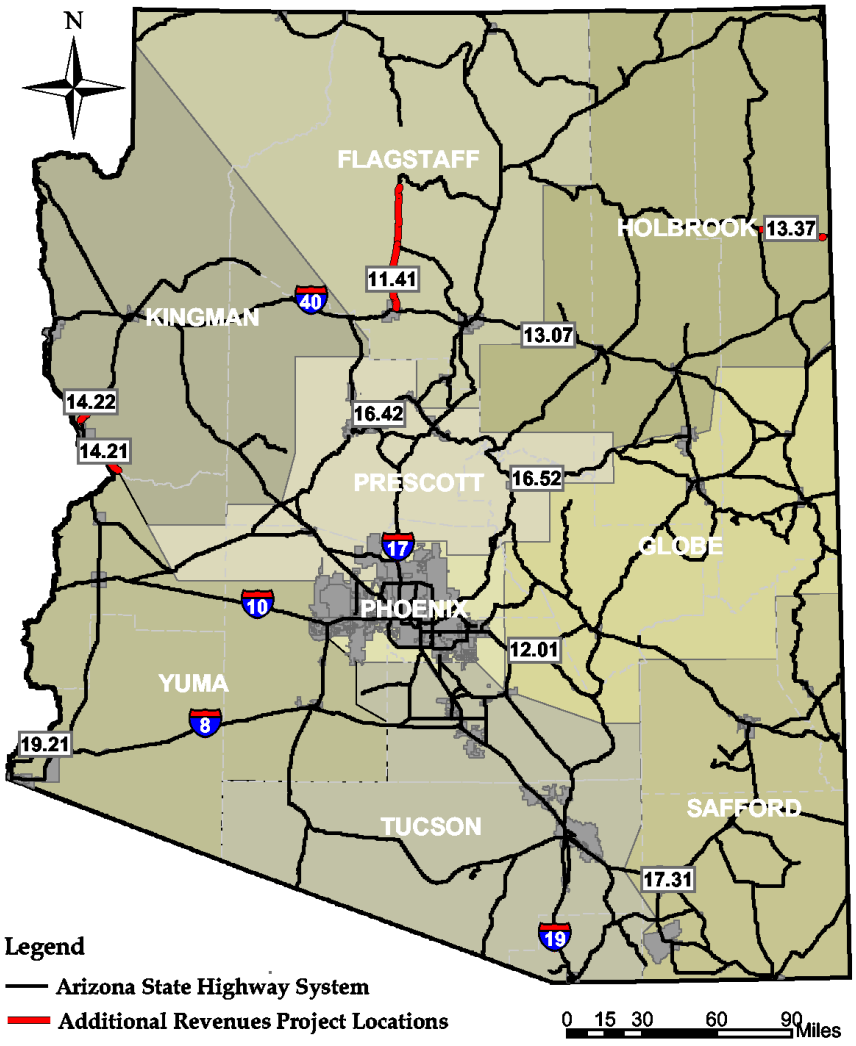
County	Funding for Major Projects ($M)	Funding for Subprograms ($M)	Total ($M)
Maricopa	626	108	**734**
Pima	192	65	**258**
13 Other Counties	387	605	**992**

The additional projects funded in this scenario are shown in Table 6.6. The locations of the additional revenue scenario projects are shown in Figure 6.3.

Table 6.6 MoveAZ Plan Projects – Additional Revenue Scenario

Project	Road	BMP	EMP	Description	Score	Cost ($M)
Projects in the 13 Other Counties						
16.42	SR 89A	320	329	Widen to 4 lanes	20	$29
13.07	I-40	230	233	Reconstruct, widen to 6 lanes, reconstruct 3 interchanges	20	$52
13.37	SR 264	446	473	Widen to 4 lanes, raised median, some segments with turn lanes, replace bridge, construct bus turnout	19	$52
16.52	SR 260	256	282	Widen to 4 lanes	18	$15
17.01	I-10	288	303	Widen to 6 lanes	18	$23
12.01	U.S. 60	212	226	Widen to 5 lanes (2 miles), construct new bypass (2 miles), construct 2 interchanges	17	$51
17.31	SR 80	294	299	Add turning lanes, widen some segment s to 4 lanes, reconstruct SR 80/ I-10 interchange	17	$38
14.22	SR 95	175	202	Widen to 4 lanes at selected locations (14 miles total)	16	$42
19.21	U.S. 95	26	31	Widen to 6 lanes	16	$19
11.41	SR 64	185	235	Add paved shoulders, widen some segments to 4 lanes (5 miles) and add turn lanes (1 mile), construct several passing lanes	15	$47
14.21	SR 95	163	172	Construct passing/climbing lanes, new signage	14	$2

Figure 6.3 Additional Revenue Scenario Project Locations (13 Other Counties Only)



Unconstrained Scenario

The MoveAZ performance analysis process is based on an assessment of a large number of projects intended to address transportation needs across the State. Because funding is limited, not all of these projects can realistically be constructed in the timeframe of a long-range plan. The unconstrained scenario is designed to identify projects that did not perform, as well as other major projects, but were identified through previous needs assessments conducted by ADOT. Table 6.7 presents the projects in the unconstrained scenario.

Table 6.7 MoveAZ Plan Projects (Unconstrained Scenario)

Project	Road	BMP	EMP	Description	Score	Cost ($M)
Projects in the 13 Other Counties						
19.31	SR 72	13	49	Add paved shoulders, improve vertical/horizontal curves on some segments	14	$59
13.35	SR 264	411	439	Construct climbing lane segments, add passing lanes (1 mile), improve intersection, construct bus turnout	13	$27
11.02	I-17	333	340	Widen to 6 lanes, reconstruct interchange	13	$35
11.24	U.S. 89A	579	613	Construct passing lane segments, widen some segments to 4 lanes (3 miles), construct bus turnout	13	$14
17.22	U.S. 191	111	121	Widen to 5 lanes	13	$34
18.51	SR 87	134	141	Widen to 4 lanes, reconstruct interchange	13	$38
13.24	U.S. 191	420	446	Reconstruct roadway, add shoulders (14 miles), and widen some segments to 4 lanes (5.5 miles)	13	$62
13.41	SR 77	362	387	Construct climbing lanes, rehabilitate 4 bridges	12	$14
19.53	SR 95	110	131	Reconstruct roadway to standards	12	$11
13.03	I-40	282	289	Widen some segments to 6 lanes, construct noise barriers	12	$19
19.61	SR 195			Construct 3 interchanges to make SR 195 a controlled access facility	12	$30
13.36	SR 264	441	446	Widen to 4 lanes, raised median (3 miles), turn lanes (3 miles), construct bus turnout	12	$16
13.25	U.S. 191	446	510	Add paved shoulders, widen some segments to 4 lanes (14 miles) with turn lanes in several locations (2 miles)	12	$94
12.04	U.S. 60	336	402	Add paved shoulders, widen some segments to 4 lanes, with some turning lanes	12	$49
14.04	I-40	71	89	Reconstruct roadway (8 miles), add climbing lanes on some segments	11	$34
12.31	SR 77	153	171	Improve shoulders and construct climbing lane segments	11	$11
13.32	SR 264	340	388	Add paved shoulders, construct climbing lanes (6 miles), turn lanes (2 miles), improve curves at 14 locations, and 4 intersections	11	$51

Table 6.7 MoveAZ Plan Projects (Unconstrained Scenario) (continued)

Project	Road	BMP	EMP	Description	Score	Cost ($M)
Projects in the 13 Other Counties (continued)						
11.01	I-17	298	322	Construct climbing lanes on some segments, reconstruct interchanges and bridges	11	$110
12.43	SR 260	331	338	Widen to 5-lane cross-section	11	$12
13.34	SR 264	386	411	Add paved shoulders, construct climbing lane segments, widen some segments to 4 lanes (5 miles), add turning lanes (6.5 miles), construct bus turnout	11	$32
11.23	U.S. 89	531	556	Improve shoulders, construct passing lane segments (2 miles) and 4 lane segments (2 miles)	11	$18
14.05	I-40	91	120	Reconstruct roadway, widen some segments to 6 lanes (18 miles), reconstruct two interchanges	11	$111
17.23	U.S. 191	130	144	Construct climbing lane segments, construct bypass (5 miles)	11	$22
13.04	I-40	292	311	Reconstruct roadway	10	$75
17.12	U.S. 70	335	349	Widen to 4 lanes, raised median, some segments with turn lanes	10	$19
13.21	U.S. 191	344	365	Reconstruct roadway, add passing lane	10	$52
11.32	U.S. 160	321	323	Widen to 5 lanes, add paved shoulders (1 mile)	10	$27
12.61	SR 79	132	150	Widen to 4 lanes	10	$60
12.11	U.S. 70	253	287	Add shoulders, widen some segments to 4 lanes with occasional turning lanes, lengthen passing lane (0.5 mile)	9	$66
11.51	SR 264	322	340	Add paved shoulders, widen some segments to 5 lanes (1 mile), construct climbing lane segments and bus turnout	9	$18
13.05	I-40	311	339	Reconstruct roadway and one interchange	9	$127
13.23	U.S. 191	379	412	Reconstruct roadway, add passing lane (1 mile)	9	$133
13.06	I-40	339	360	Reconstruct roadway, reconstruct 2 interchanges	9	$113
18.22	SR 77	92	95	Construct climbing/passing lanes at selected locations	9	$1
11.31	U.S. 160	336	343	Construct passing and climbing lanes	8	$2

Table 6.7 MoveAZ Plan Projects (Unconstrained Scenario) (continued)

Project	Road	BMP	EMP	Description	Score	Cost ($M)
Projects in the 13 Other Counties (continued)						
17.24	U.S. 191	154	165	Widen shoulders, raise bridge	8	$25
17.25	U.S. 191	23	27	Reconstruct roadway, widen to 4 lanes	8	$14
11.11	I-40	155	165	Reconstruct segments (2 miles)	8	$14
17.61	SR 266	104	123	Widen shoulders	8	$5
12.21	SR 73	310	335	Widen shoulders	8	$13
14.01	I-40	37	44	Reconstruct and widen to 6 lanes, reconstruct two interchanges	7	$63
14.06	I-40	123	144	Reconstruct roadway	7	$86
13.11	U.S. 160	361	384	Add passing lanes at selected locations	7	$7
18.61	SR 287	134	142	Widen to 4 lanes, construct 2 new interchanges	7	$56
12.06	U.S. 60	252	337	Construct selected passing and climbing lane segments	7	$28
11.22	U.S. 89	498	504	Construct passing lanes	6	$2
13.22	U.S. 191	370	379	Reconstruct roadway	5	$24
17.26	U.S. 191	45	65	Reconstruct roadway	5	$77
12.03	U.S. 60	260	273	Construct selected passing and climbing lane segments	3	$2
12.51	SR 277	331	336	Widen to 5 lanes	3	$26
11.16	I-40	226	233	Reconstruct roadway, add some climbing lane segments, reconstruct traffic interchange	2	$25
17.02	I-10	310	325	Construct selected climbing lane segments	2	$21
17.11	U.S. 70	287	329	Repair shoulder segments, move headwalls	2	$11
19.02	I-8	17	20	Add paved shoulders	2	$2
19.52	SR 95	147	161	Add turn lane, new signage	2	$32
12.42	SR 260	317	335	Construct selected passing/climbing lane segments, add paved shoulders	1	$3
17.21	U.S. 191	87	104	Widen shoulders	1	$9
11.12	I-40	167	196	Construct climbing lane (1 mile), reconstruct 4 interchanges, widen 2 bridges, construct noise barriers	0	$84
17.71	SR 366	136	143	Reconstruct as a paved roadway	0	$15

6.3 State Performance Results

In addition to analyzing the performance impact of project bundles, ADOT assessed the overall system performance of the constrained and additional revenue scenarios. These assessments are based on a slightly more limited set of the same performance measures used to evaluate project performance. Some measures, such as project consistency with RTPs, lack natural baselines and, therefore, cannot be included in the state performance analysis. The purpose of these results is to measure how much can be done to maintain system performance at current levels, the general threshold specified in the MoveAZ Plan. Table 6.8 shows expected system performance for the 2002 base, 2025 base (without MoveAZ projects), the constrained scenario, and the additional revenue scenario.

From 2002 to 2025, Arizona will face significant challenges to its ability to maintain system performance. Rapid population growth will fuel demand for travel in the State, creating mobility, connectivity, environmental, and other concerns. Some of the greatest impacts are expected in the area of mobility. Without new investment, less than 40 percent of all motor vehicle travel will occur in free-flow conditions in 2025, compared to nearly three-quarters of all motor vehicle travel in 2002. Delay per trip will jump from just over a minute per trip to seven minutes per trip. Although this may seem insignificant, motorists will experience greater delays at peak periods in urbanized areas. Delay resulting from incidents, such as crashes, will more than triple.

On high-priority corridors in the State, increases in travel time will vary. Some corridors, such as Flagstaff to Page and Phoenix to Globe, will see only moderate increases. Others, such as Phoenix to the Hoover Dam along U.S. 93, will see travel times nearly double. The ability to pass in major two-lane corridors – the other measure of connectivity – will become roughly 50 percent more difficult in 2025 than in 2002.

Increased traffic will also substantially increase fuel consumption and vehicle emissions, and reduce the bicycle suitability of many of Arizona's roadways.

Using the performance measures designed to address the safety factor, safety will actually improve from 2002 to 2025. Although small increases in vehicles on a given roadway will increase the potential for crashes to occur, the massive volume of traffic expected in 2025 will reduced speeds enough to actually reduce the number of crashes that occur on the state system, as well as reducing the rate of injuries.

Constrained Scenario System Performance

Under the constrained scenario, system performance improves significantly across the State. This improvement is evident from every ADOT performance measure. Mobility improves substantially, with over one-half of all traffic expected to take place in free-flow conditions. Delay per trip is reduced to almost one-third of the 2025 level at 2.5 minutes per trip, and unexpected delay is reduced by more than one-half.

Table 6.8 System Performance Results for Constrained and Additional Revenue Scenarios

Measure	2002 Base	2025 Base	Constrained Scenario	Additional Revenue Scenario
Mobility factor				
% PMT at LOS A-C or D (rural or urban)	77%	38%	54%	55%
Average delay per trip (minutes:seconds)	1:17	6:58	2:29	2:28
Reliability factor				
Unexpected delay (minutes:seconds)	0:48	3:11	1:27	1:27
Safety				
Crash rate per 100 million VMT	421.0	415.7	411.2	411.4
Injury rate per 100 million VMT	157.1	155.8	153.7	153.8
Accessibility				
Average bike suitability (24-point scale)	12.9	11.6	12.0	12.2
Moderate bike suitability (12-18%)	56%	48%	40%	39%
High bike suitability (19-24%)	23%	14%	16%	17%
Resource conservation				
Emissions (tons per day)	771	1,288	1,265	1,265
Fuel consumption (1,000 gallons per day)	4,304	11,888	10,747	10,747
Connectivity				
Passing ability (LOS ratio)	0.82	1.23	1.16	1.13
Intercity connectivity (total travel time by corridor)				
Douglas – Benson (SR 80)	2:12	2:34	2:32	2:32
Phoenix – Hoover Dam	4:48	7:57	7:46	7:46
Flagstaff – Page	2:26	2:27	2:27	2:27
Phoenix – Globe	1:03	1:04	1:04	1:03
Phoenix – Lukeville	2:31	4:35	4:30	4:30
Phoenix – Mogollon Rim	3:14	4:48	4:48	4:48
Prescott – I-17 (Cordes Junction)	0:47	1:20	0:42	0:42
Yuma – Bullhead City	3:47	4:00	3:59	3:59
Tucson – Holbrook	4:33	4:45	4:45	4:45

Base (2002) to Base Future (2025) System Performance

Under the constrained scenario, both the crash and injury rates are reduced below the 2025 baseline. This slower increase – not an absolute reduction – likely results from the reconstruction of several roadways as divided highways and the addition of shoulders to other roads.

Average bike suitability of state routes improves moderately, although this improvement is concentrated at the low and high ends of the bike suitability scale. An additional two percent of roadway miles move into the highly suitable category, while the average suitability in the low category improves.

Emissions and fuel consumption are also both reduced slightly by the constrained scenario, relative to the 2025 base scenario. With thousands of new vehicle miles traveled everyday, however, it is difficult to provide substantial improvements to these measures. Furthermore, when speeds are improved substantially (e.g., above 45 miles per hour), both fuel consumption and emissions begin to increase.

Finally, both measures of connectivity improve under the constrained scenario. Passing ability shows a roughly six percent improvement, while several of the corridors show small improvements in travel time. One corridor, from Prescott to I-17 (Cordes Junction), is expected to improve to better than the 2002 travel time. This corridor, the shortest of the corridors evaluated, would be affected by major improvements to SR 69, including widening the roadway to six lanes. Roadway widening will substantially reduce congestion in the corridor.

Additional Revenue Scenario

Under the additional revenue scenario, roadway performance improves moderately over the constrained revenue scenario. The additional revenue scenario differs in an important aspect from the constrained scenario, however, in that it includes only projects outside Maricopa and Pima Counties. For Maricopa, the MAG RTP included only a constrained scenario in compliance with Federal regulations. However, if funding in the additional revenue scenario becomes available, needs exist in the MAG area to fully utilize the new funding. In Pima County, all projects identified by previous planning studies were fundable under the constrained scenario. Although the region will undoubtedly have additional needs by 2025, no specific projects have been identified at this time and consequently no additional projects are included for the Pima Association of Goverments (PAG) region in the additional revenue scenario. Future planning efforts by ADOT, MAG, and PAG will be used to identify specific projects that would be considered for this scenario.

7. Transportation Modes

Chapter 7. Transportation Modes

As a multimodal long-range transportation plan, MoveAZ addresses six modes of personal travel in Arizona: highway, rail, transit, air, bicycling, and pedestrian. It also addresses four modes of freight and commodity movement: truck, rail, air, and pipeline. This chapter presents the following basic data for the six passenger modes:

- The extent of the mode in Arizona, including location of facilities, types of systems, and other pertinent information;
- The demand for travel or utilization of the mode; and
- The role of ADOT in providing funding, operations, research, and other support for the mode.

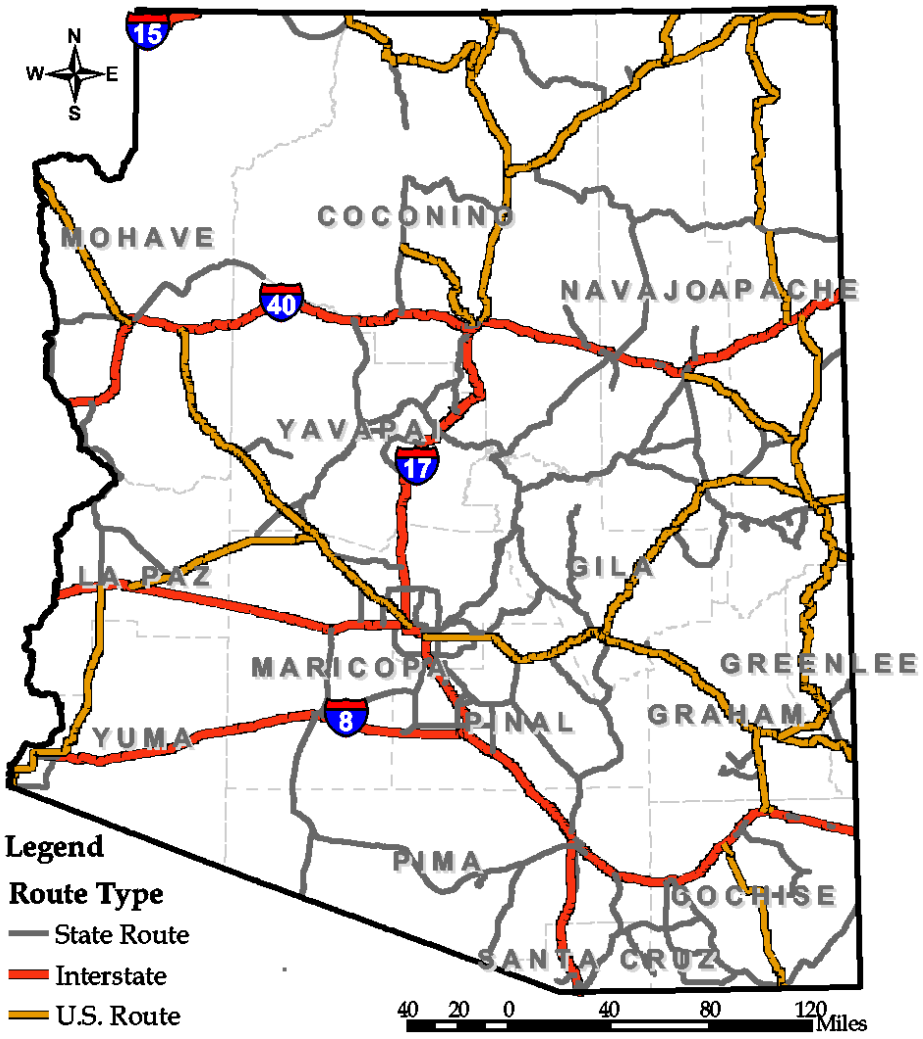
Chapter 8 provides similar information for freight modes in the context of the integrated transportation system.

7.1 Highways

Extent of the Highway System

The Arizona highway system consists of over 58,000 miles of roadway, of which two percent are interstates, three percent are U.S. routes, and nearly six percent are state routes. Although only 12 percent of the total highway network are state facilities, over 57 percent of the daily VMT occur on these roads. The Interstate System – which is part of the state highway system – carries 28 percent of all daily VMT.

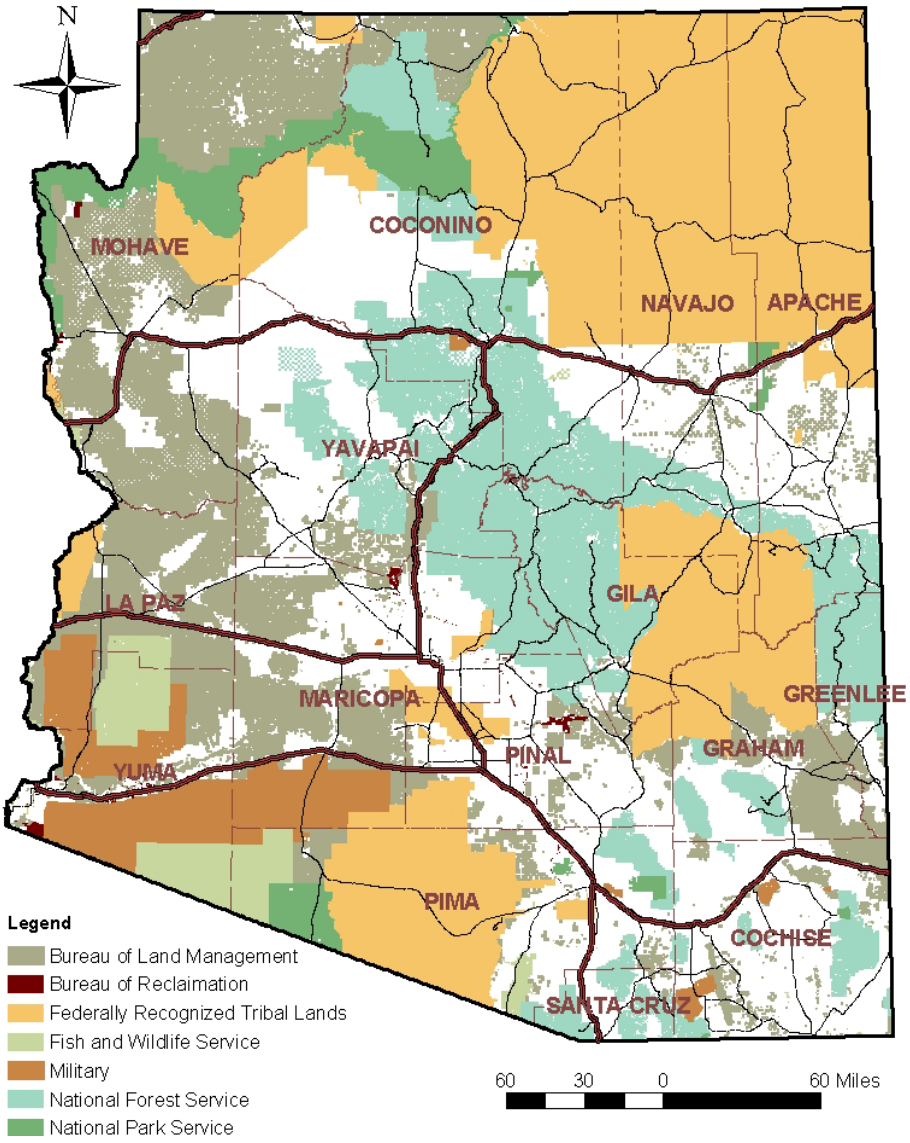
Figure 7.1 Arizona State Highway System by Route Type



Federal and Tribal Lands

Much of the Arizona State Highway System passes through lands owned by Federal agencies and Federally-recognized tribes. Federal agencies and Federally-recognized tribes own 70 percent of the land in Arizona. Federal lands agencies, including the U.S. Forest Service, the Bureau of Land Management, and others, own 42 percent of the land in Arizona, with over 2,000 miles of state highway passing through these lands. Arizona's 21 Federally-recognized tribal nations own 28 percent of Arizona land. An additional 1,200 miles of state highway pass through these lands, with over one-half of these road-miles in the Navajo Nation. The Navajo Nation is the largest tribal reservation in the State, covering nearly 16,000 square miles in Arizona and extending into Utah, New Mexico, and Colorado. Arizona's Federal and tribal lands and their relationship to the state highway network are shown in Figure 7.2.

Figure 7.2 Federal and Tribal Land Ownership



Intelligent Transportation Systems

Intelligent Transportation Systems (ITS) refers to a set of strategies that can improve the management of roadway operations, and provide additional capacity and efficiency of state roads at reduced cost. ITS solutions and strategies often provide safety and law enforcement benefits as well. ITS is extensively used throughout Arizona, particularly in the Phoenix and Tucson metropolitan areas.

In the Phoenix-Mesa metropolitan area, ADOT operates 50 miles of freeway management system on eight corridors, including vehicle detection stations, variable message signs, closed-circuit television cameras, and a 24-hour traffic operations center. Information

collected through the ITS infrastructure is shared with the public via radio, telephone, Internet, and public kiosks operated as part of the AZTech™ public-private partnership. Several jurisdictions in the Phoenix-Mesa metropolitan area, including the Maricopa County DOT and the Cities of Phoenix, Chandler, Gilbert, Glendale, Mesa, Peoria, Scottsdale, and Tempe, have implemented ITS infrastructure, including synchronized signalization and signal preemption for emergency vehicles.

ADOT also provides incident management through its Arizona Local Emergency Response Team (ALERT). The Road Closure and Restriction System allows the reporting of conditions on arterial streets. Local, county, and state government agencies involved in traffic management and emergency response share information through operations centers and the AZTech™ partnership.

In the Tucson metropolitan area, three components of the ITS infrastructure provide service to highways: the Arterial Traffic Management System, the Freeway Management System, and the Regional Traveler Information Center. The City of Tucson's Traffic Control Center uses video detection cameras to coordinate signals and operate the Arterial Traffic and Freeway Management Systems. The Regional Traveler Information Center gathers roadway conditions information into a central clearing house for dissemination to the public.

ITS infrastructure for transit has also been implemented in both the Phoenix and Tucson metropolitan areas. Those technologies are described in the transit section of this chapter.

Demand for Roadway Travel

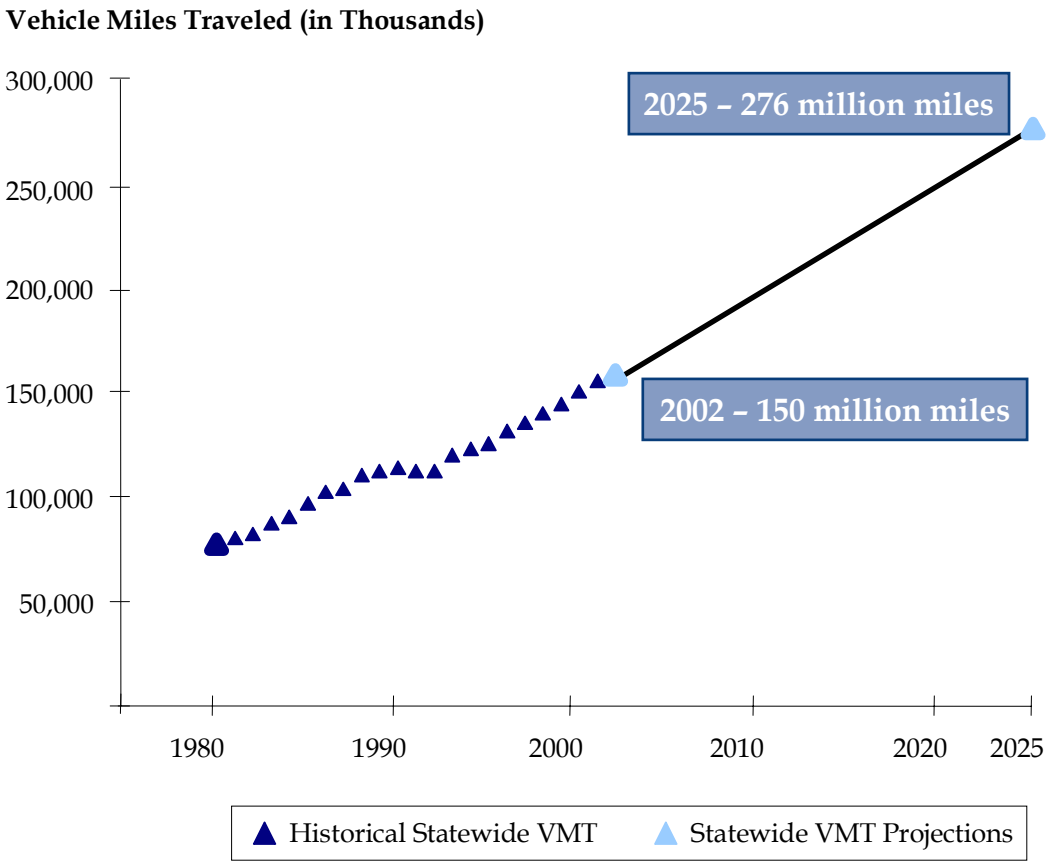
Of all the components of Arizona's transportation system, the road network (including state and local roads) is the largest and most extensively used. Most residents and visitors travel these roads by private automobile. MoveAZ included a process to estimate and forecast total highway travel in Arizona. As described in Chapter 4, the estimate and forecast were used to support the performance analysis of specific transportation projects. Two sources were used for the estimate and forecast:

1. For urbanized areas of the State (Phoenix, Tucson, Yuma, and Flagstaff metropolitan areas), regional travel demand models provided traffic estimates and forecasts; and

2. For the remaining counties or portions of counties not covered by these models, VMT was estimated and forecast using projections of population and employment in the county.

As shown in Figure 7.3, approximately 150 million vehicle miles were traveled on Arizona's state and local roads in 2002. This total is projected to grow to 276 million vehicle miles in 2025.

Figure 7.3 Historical and Projected VMT in Arizona



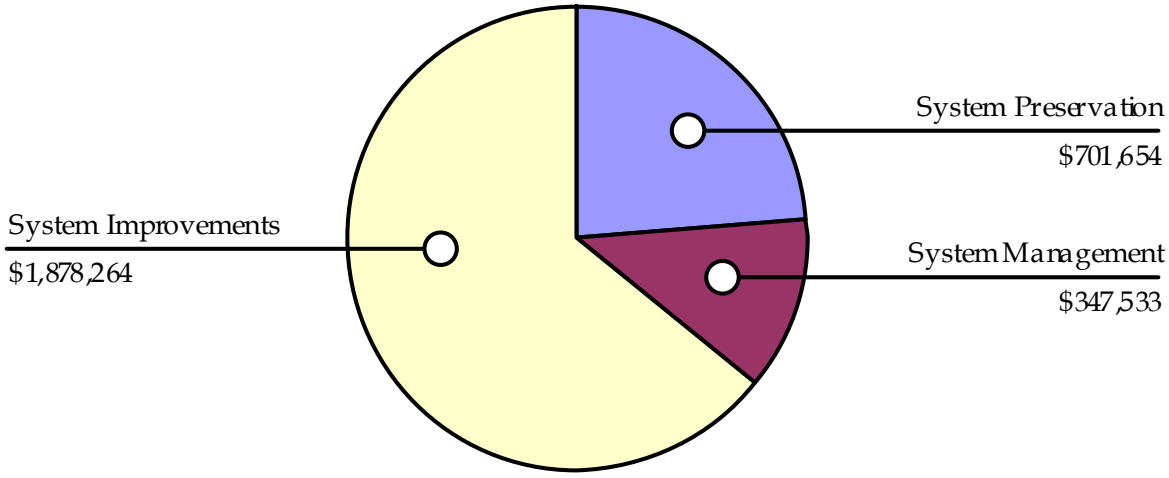
Source: Cambridge Systematics, Inc., and Lima and Associates, 2003.

ADOT's Role in Highway Transportation

The MoveAZ Plan deals extensively with the highway system. ADOT is responsible for developing and maintaining this system, and works with regional and local jurisdictions across the State to identify needs and the projects to address them.

Each year, ADOT updates the *Five-Year Transportation Facilities Construction Program* that identifies all of the projects that ADOT will build on the state transportation system over the next five years. In the 2004 to 2008 five-year program, ADOT will invest close to $3 billion in total in all facilities (Figure 7.4). Over $700 million will be invested in system preservation activities, such as pavement maintenance, bridge maintenance, and safety projects over this timeframe. Nearly 350,000 will be invested in system management activities, such as operating support and contingency funding. An additional $1.9 billion will be invested in system improvements, such as roadway widening, new interchanges, and other capital expansion projects.

Figure 7.4 ADOT Five-Year Program Investments, 2004 to 2008



7.2 Railroads

Extent of Arizona's Rail System

As shown in Figure 7.5, there are 2,654 miles of railroad track in Arizona, including mainline, spurs, and yards. Railroads operate 1,909 route-miles of track in the State, primarily for freight movement (described in Chapter 8). Two freight railroad operators, the Union Pacific (UP) and the Burlington Northern-Santa Fe (BNSF), own 70 percent of the track-miles, while small local railways or the Federal government own the rest. There are 1,639 highway-rail crossings in the State of Arizona, 940 public and 692 private.

Passenger Rail Utilization and Demand

Amtrak provides three intercity rail services: the Southwest Chief, the Sunset Limited, and the Texas Eagle. The first of these services provides daily stops in Winslow, Flagstaff, Williams, and Kingman. The latter two each provide service three days per week, with stops in Benson, Tucson, Maricopa, and Yuma. The Grand Canyon Railway and Resort operates one round trip per day between Williams and Grand Canyon National Park. Annual rail passenger boardings at passenger stations in Arizona are shown in Table 7.1. Current year (2002) and future forecasts (2025) of intercity rail utilization were generated using population and employment estimates and projections (Table 7.2).

Figure 7.5 Railway Network in Arizona

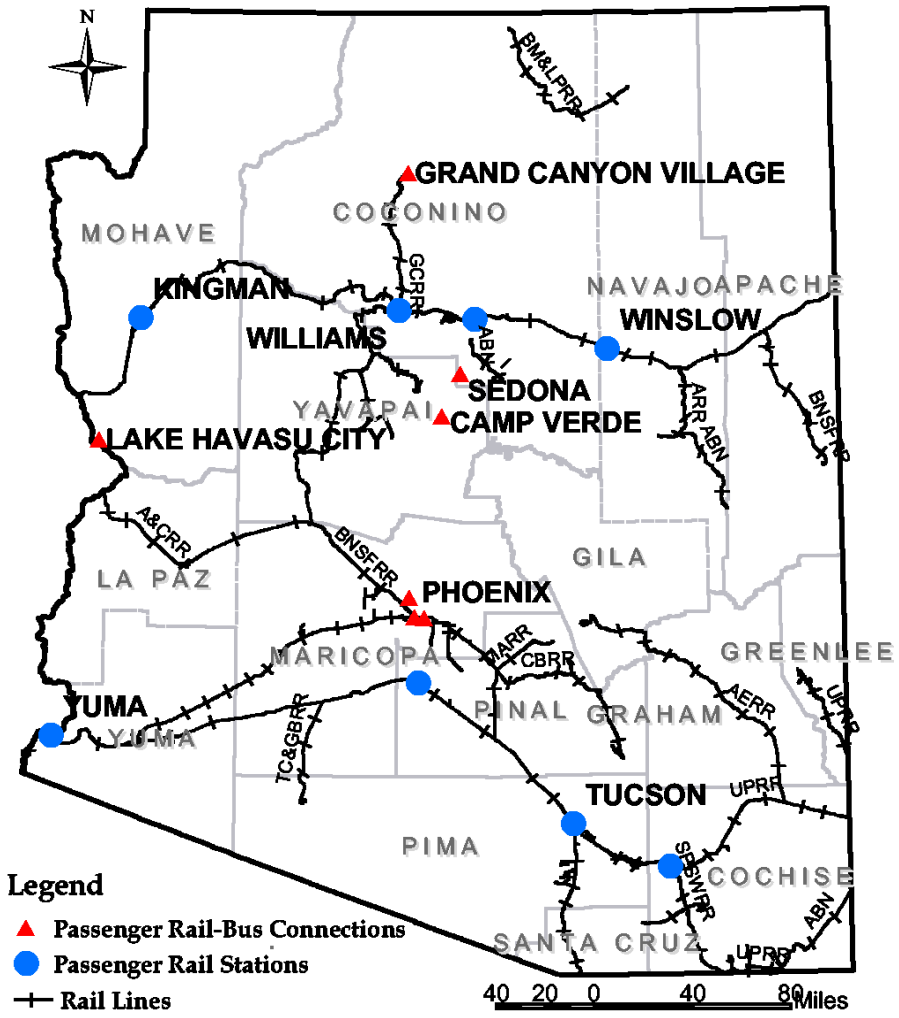


Table 7.1 Annual Passenger Rail Counts in Arizona, 2000

Railway	Station	Boardings
Sunset Limited & Texas Eagle (UP)	Benson	1,900
	Tucson	25,700
	Yuma	2,500
	Phoenix (connecting bus service)	7,950
Southwest Chief (BNSF)	Flagstaff	44,900
	Williams	5,000
	Kingman	3,100
	Winslow	2,200
	Grand Canyon (connecting bus service)	400
	Phoenix (connecting bus service)	450
Grand Canyon Railroad	Grand Canyon	19,000
Arizona Central Railway	Clarkdale	7,200
Total		**120,300**

Source: Arizona Department of Transportation, 2000.

Table 7.2 Estimated Daily Intercity Rail Boardings for 2002 and 2025

County	2002	2025
Maricopa	24	39
Mohave	9	15
Pima	73	105
Navajo	6	9
Cochise	5	8
Coconino	146	222
Yuma	7	11
Total	**270**	**409**

Source: Cambridge Systematics, Inc., 2003.

Higher-speed passenger rail service has been a subject of considerable discussion in Arizona. In 1998, ADOT completed a *High-Speed Rail Feasibility Study* for high-speed passenger rail service in the Phoenix-Tucson corridor. A system capable of operating at an average speed of 120 miles per hour was estimated to attract 3.2 million annual passengers in the year 2020, with a capital construction cost of $3.8 billion. By comparison, similar capacity could be added in the Phoenix-Tucson corridor by widening I-10 from a four- to a six-lane facility. According to ADOT's 1999 *Phoenix to Tucson Multimodal Corridor Profile Study*, this would cost between $300 million and $400 million, and would provide sufficient capacity for at least four million additional automobile trips each year.

ADOT's Role in Rail Transportation

ADOT does not build or operate rail systems in Arizona. Across the United States, very few state DOTs own or operate rail systems. Tracks are typically owned by freight rail operators; and passenger rail systems, such as Amtrak, pay to use the track. ADOT provides support to the rail system by sponsoring key studies, such as the high-speed rail feasibility study described above and studies of goods movement, of which rail is a key component. ADOT's Regional Transportation Profiles and other studies will continue to support the evaluation of rail alternatives to improve mobility, reduce congestion and emissions on the state highway system, and provide transportation options to Arizonans. ADOT evaluates the preservation of abandoned rail right of way for possible future uses, including restored rail service and bicycle or mixed-use trails. In addition, ADOT examines the need to improve and/or upgrade highway grade crossings at key locations where safety concerns exist.

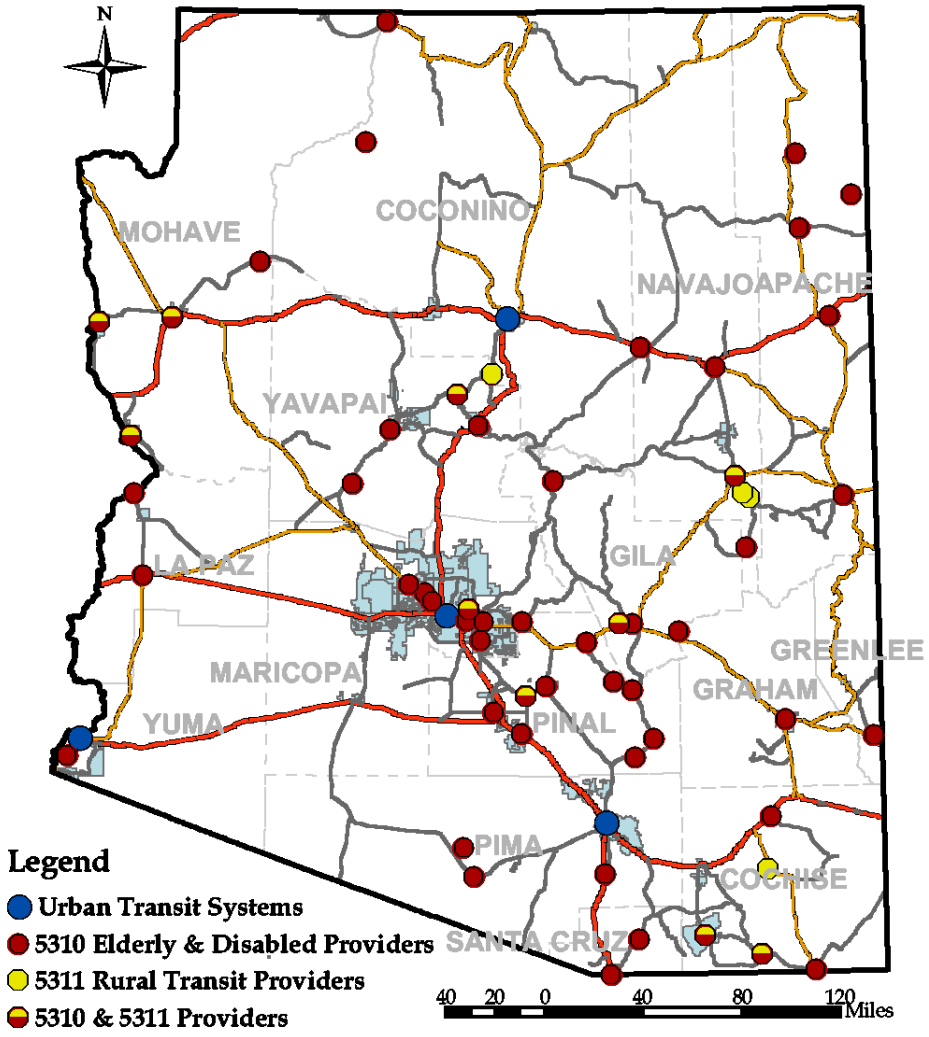
More detail on the freight rail transportation system is provided in Chapter 8.

7.3 Transit

Extent of Arizona's Transit Systems

Although the majority of passenger travel in Arizona takes place by private automobile, public transportation provides an important mobility alternative for those who cannot or choose not to drive or do not have access to an automobile. Arizona is served by a variety of local, regional, and intercity public transportation services that connect homes with jobs, schools, shopping centers, medical complexes, and other destinations (i.e., purposes not dissimilar to those traditionally provided by the private automobile trip). In addition to these general services, Arizona has numerous services for "transit-dependent" populations, such as the elderly, disabled, and economically disadvantaged. Communities that had the following three types of transit services are shown in Figure 7.6:

Figure 7.6 Transit Services in Arizona



Source: Arizona Department of Transportation, and Cambridge Systematics, Inc., 2004.

1. Urban transit systems;

2. Rural transit systems funded by the Federal 5311 program; and

3. Transit systems for special needs populations (elderly and disabled) funded by the Federal 5310 program.

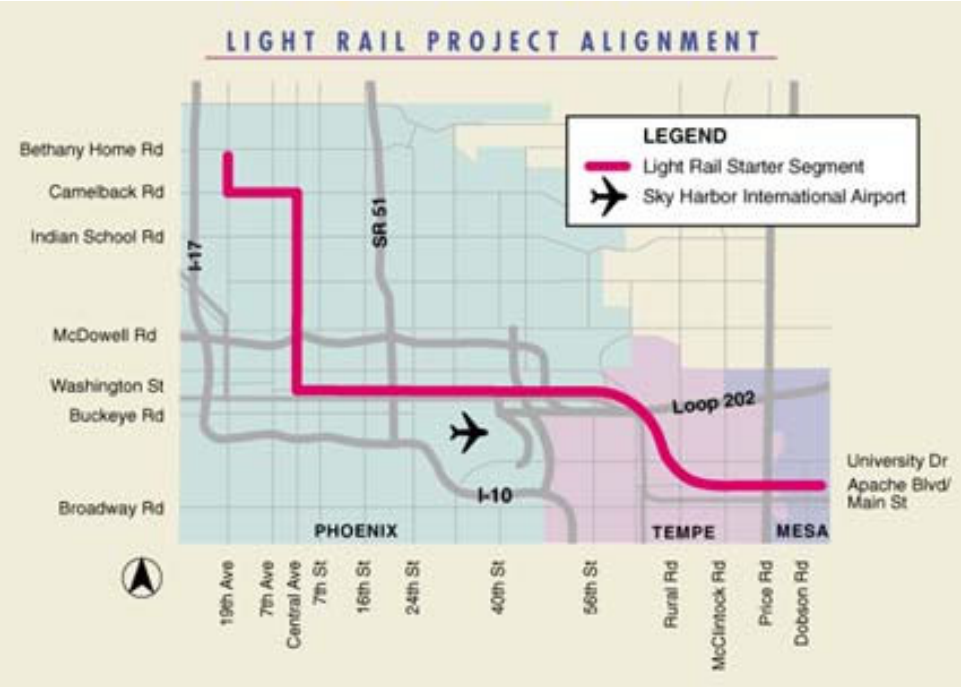
Local and Regional Urban Transit

As shown in Figure 7.6, Arizona has urban public transportation systems in four metropolitan areas with populations over 50,000: Phoenix, Tucson, Flagstaff, and Yuma. The

Prescott region, which was declared the Central Yavapai Metropolitan Area following the 2000 Census, currently does not operate an urban transportation system.

In the Phoenix metropolitan area, Maricopa County and the Cities of Phoenix, Mesa, Tempe, Scottsdale, Chandler, Peoria, Gilbert, Glendale, Avondale, and El Mirage have formed the Regional Public Transportation Authority (RPTA) to provide a unified structure for transit services operating under the Valley Metro brand. The Valley Metro system includes 60 fixed routes that operate primarily on arterial streets, 20 limited-stop express routes (including four RAPID commuter express routes), six circulator and shuttle routes, and 11 demand-response services that provide door-to-door service on request. Most Valley Metro buses are equipped with electronic fare payment systems. All buses and most demand-response vehicles in the Valley Metro system are equipped with a state-of-the-art vehicle management system that includes a computer-aided dispatch system, vehicle location system with real-time information on bus locations, upgraded radios, and internal stop and public information announcement systems. Valley Metro is designing and building the State's first light-rail transit system, shown in Figure 7.7, and scheduled to open in late 2008. ADOT will perform an important safety and security role for the light-rail system, establishing program standards and guidelines through the Federal Transit Administration (FTA).

Figure 7.7 Phoenix Approved Light-Rail System



Source: Regional Public Transportation Authority.

Several municipalities, such as Glendale, Phoenix, and Tempe, operate circulator services in their central business districts. Arizona State University operates two shuttle routes

between its campuses. The Salt River Transit System provides rural-based route deviation transit services on three routes, and demand-response service in rural areas on the fringe of the Phoenix metropolitan area.

In Tucson the City operates SunTran with 28 fixed routes and nine limited-stop express routes. The City's VanTran operation provides demand-response service to persons with disabilities. The City also operates three circulator routes in the downtown Tucson area, known as Tucson Inner City Express Transit. The University of Arizona operates five CatTran shuttle routes in the vicinity of its Tucson campus. The Town of Oro Valley provides the CoyoteRun demand-response service for the elderly, disabled, and low-income population. Pima County operates fixed-route transit service in rural areas and Tribal communities surrounding Tucson and intercity service from Ajo into Tucson. In Tucson, a Transit Management System is integrated with other regional ITS, and includes automatic vehicle locator technology, as well as electronic fare collection systems on SunTran buses.

In Flagstaff, Coconino County operates four fixed routes supported by Federal transit grants, known as Mountain Line Transit. The County also operates the VanGo demand-response service for persons with disabilities, as well as for the general public when space is available. Northern Arizona University operates Mountain Campus Transit on four fixed routes on and near its campus.

The Yuma Metropolitan Planning Organization (YMPO) currently operates two fixed routes as Yuma County Area Transit (YCAT). These routes currently provide between six and eight round trips per day on the two routes. The YMPO also operates a demand-response service for persons with disabilities. These systems are also supported by Federal transit grants.

Rural and Small Town Transit Services (Section 5311)

Fourteen communities in rural areas and in small urban areas with populations under 50,000 provide transit services that are eligible for Federal funding under the ADOT Section 5311 program. Transit services in these areas generally operate less frequently and more flexibly than their counterparts in urban areas. Cottonwood, Lake Havasu City, and the Town of Miami provide door-to-door demand-response services with advance reservation. Bisbee, Coolidge, Sierra Vista, Kingman, Salt River Indian Community, Bullhead City, and Sunsites provide services on established routes that deviate on request to pick up or drop off customers at locations within a specified service area. The Hopi and Navajo Nations both provide service between cities on and around their reservations. The Show Low Transit System Four Seasons Connection and Pima County provide fixed-route service on two connected routes, one each in Show Low, Pinetop-Lakeside, and Hon Da Casino. In addition, the National Park Service operates free shuttles between parking areas and attractions in Grand Canyon National Park.

Transportation for the Elderly and Disabled (Section 5310)

More than 100 private non-profit and public agencies that provide transportation to the elderly and disabled are eligible for Federal funding for vehicle purchases under the ADOT Section 5310 program (see Figure 7.6 above).

Intercity Passenger Bus

Greyhound Lines provides the majority of long-distance bus service in Arizona, both in terms of destinations served and service frequency. Greyhound serves 48 communities, including the Phoenix Sky Harbor International Airport and the Benson and Tucson Amtrak stations. Most of its routes operate in interstate highway corridors, with the greatest service frequency in the I-10 corridor between Phoenix and Tucson (18 one-way trips per day).

In addition to Greyhound, five regional bus operators provide scheduled service, tours, and/or charters in Arizona. K-T Services operates shared route service with Greyhound between Phoenix and Las Vegas. Some rural transit operators in the ADOT-sponsored Section 5311 program, such as Hopi Senom Transit System, Navajo Transit System, Sunsites Transportation, and Pima County, provide scheduled service to major cities. Some tour companies, such as Gray Line Tours, operate scheduled tours to major attractions from larger cities.

Transit Demand and Utilization in Arizona

Transit demand was estimated for most of the types of transit service described above. Because many demand-responsive transit systems do not record passenger boardings, it was not possible to estimate demand or utilization for these systems. The methods for estimating demand or future utilization for the remaining systems use a combination of historical data on transit ridership and existing methodologies employed in other states to develop estimates of transit demand and utilization. The detailed procedures required to estimate demand or future utilization for each type of transit are provided in Appendix F.

Urban bus ridership estimates were prepared by scaling the historical ridership data for MAG, PAG, and the Flagstaff Metropolitan Planning Organization (FMPO) regions. Because the urban bus service provided in YMPO was not operating when the MoveAZ Plan was completed, no forecast was prepared. A scaling factor was developed for 2025 from population and employment growth. In the MAG region, these forecasts were adjusted to reflect planned service expansion as described in the MAG RTP. Planned service expansion for the PAG region was already included in the existing ridership projections. The forecasts represent utilization of the existing or planned transit system. Predicted bus ridership in the four metropolitan regions is shown in Table 7.3.

Table 7.3 Estimated Annual Urban Bus Ridership, 2002 and 2025

County	2002	2025
MAG Region	43,524,000	67,101,000
PAG Region	15,925,000	27,015,000
FMPO Region	143,000	202,000
Total	**59,592,000**	**94,318,000**

Source: Cambridge Systematics, Inc., 2003.

Rural bus forecasts were based on population and employment growth, as well as on methodologies used in other similar planning efforts. Key statistics required to implement these approaches include annual revenue vehicle-miles (RVM); catchment area within the county; and population by age, mobility limitations, and income. Future transit studies conducted by ADOT and other agencies will provide an opportunity to update these demand estimates, and also improve upon the methods used to estimate transit demand in rural Arizona.

Intercity bus forecasts were estimated from existing planning methods used by the U.S. DOT's *Planning Techniques for Intercity Transportation Services Report*. This report estimates ridership of various lengths from round trip frequency, total population served along a route, and fare per mile. The forecasts do not reflect the potential for route deletions, schedule modifications, new service, or travel time changes due to highway congestion. Total estimates of rural and intercity bus ridership by county are shown in Table 7.4.

ADOT's Role in Transit

ADOT administers two Federally-funded transit grant programs:

1. The Elderly and Persons with Disabilities Program (Section 5310) that provides nearly $3 million annually to special needs transportation providers; and

2. The Rural Public Transportation Program (Section 5311) that provides up to $4 million annually aimed primarily at 14 rural transportation providers.

In recent years, these programs were administered by the Transit Section of the Transportation Planning Division. In 2004, the Transit Section became a separate Public Transportation Division within ADOT. The Transit Division will have primary responsibility for conducting transit studies and working with municipalities and transit operators to ensure quality service and identify funding for transit programs in Arizona. The Transit Division will take responsibility for the 5310 and 5311 programs.

Table 7.4 Estimated Daily Rural and Intercity Bus Ridership for 2002 and 2025

	Rural Bus		Intercity Bus	
County	**2002**	**2025**	**2002**	**2025**
Apache	183	248	<1	<1
Cochise	278	428	<1	<1
Coconino	105	186	31	38
Gila	144	220	1	1
Graham	75	122	1	1
Greenlee	13	18	<1	<1
La Paz	58	102	2	2
Maricopa	393	789	495	685
Mohave	470	922	17	24
Navajo	247	381	2	2
Pima	787	1,404	94	117
Pinal	436	786	6	8
Santa Cruz	84	145	1	1
Yavapai	480	944	9	12
Yuma	366	661	15	21
Total	**4,119**	**7,356**	**674**	**913**

Source: Cambridge Systematics, Inc., 2003.

Over the last several years, the ADOT Transportation Board has approved $1.5 million in Surface Transportation Program "Flex Funds" to address additional capital needs for Section 5310 agencies, and has approved $5 million statewide for Rural Transit Programs (Section 5311) and Urban Transit Programs (Section 5307), or approximately $1 million and $4 million, respectively.

ADOT also supports transit through a variety of transportation planning efforts. All multimodal corridor profile studies and numerous small area transportation studies conducted by the Transportation Planning Division include an examination of transit needs in the region studied. MoveAZ included a detailed analysis of the extent of transit services and demand for transit, as shown in this chapter. In addition, the Transportation Board has adopted the MAG RTP as the official state plan for the MAG region. The RTP offers MAG a high degree of flexibility in funding its regional transit system.

In addition to identifying transit needs and alternatives in the multimodal corridor profiles, ADOT has also committed to examining public transportation needs in rural Arizona. ADOT intends to conduct rural transit needs analyses in each Council of Government area in the State. ADOT will also work with the Arizona Transit Association to ensure that transit representatives have the opportunity to participate on the Technical

Advisory Committees of studies conducted by the Transportation Planning Division, including multimodal corridor profiles, small area transportation studies, and modal studies, such as the transit studies described above and the State bicycle/pedestrian plan.

As described in Chapter 3, numerous participants at the public meetings identified transit funding as a major concern in the State. Current state law requires the Highway User Revenue Fund (funded from gas taxes and vehicle license fees) to be spent on highways. One clear suggestion raised by the Arizona Transit Association was to reestablish the Local Transportation Assistance Fund II (LTAF II). The original LTAF provided local funding assistance from lottery games and the state vehicle license fee. LTAF II was funded from the state general fund and was required, for most communities, to fund transit. Due to pressure on the general fund from the recent economic recession, funding through LTAF II has been limited since 2002. In 2000, $30 million was provided to support transit in local areas through LTAF II. Reestablishing this funding mechanism for rural transit would help improve mobility in rural areas, especially for disadvantaged and mobility-challenged populations.

7.4 Aviation

Extent

As shown in Figure 7.8, there are 83 public-use airports in Arizona, 11 of which are certified to handle scheduled commercial air service. The remaining 72 airports provide general aviation and emergency response services. Another 236 airports across the State are private-use and accommodate airplanes, gliders, helicopters, and other forms of aviation.

There were over four million take-offs and landings at Arizona airports in 2002, nearly 3.5 million of which were general aviation operations. Sky Harbor in Phoenix is the State's busiest commercial airport, with over 480,000 commercial take-offs and landings in 2002. Other airports with substantial commercial operations include Tucson International, Yuma International, and the Grand Canyon National Park airports. Sky Harbor and Tucson airports are qualified to handle cargo planes in addition to passenger planes.

Aviation Demand in Arizona

Almost 21 million passenger enplanements were reported across 39 of Arizona's public-use airports in 2000, most at the Phoenix Sky Harbor and Tucson International Airports. Sky Harbor was the fifth busiest airport in the nation in 2001 in terms of operations, with over 550,000 take-offs and landings. Tucson was ranked 45th. As shown in Table 7.5, Grand Canyon National Park Airport and Laughlin/Bullhead International were the third and fourth busiest airports in the State in terms of passenger enplanements.

Figure 7.8 Aviation Network in Arizona

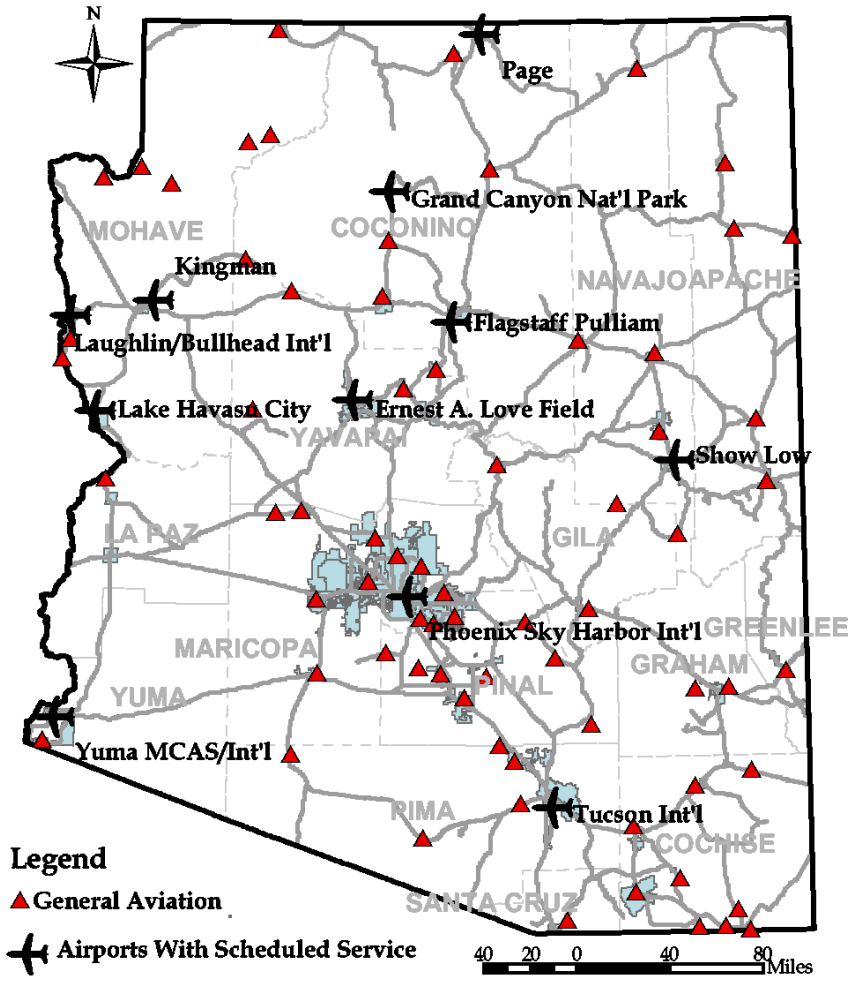


Table 7.5 Airport Enplanements in Arizona, 2000

Airport	City	Enplanements
Phoenix Sky Harbor International	Phoenix	17,568,900
Tucson International	Tucson	1,816,400
Grand Canyon National Park	Grand Canyon	411,400
Laughlin/Bullhead International	Bullhead City	75,000
Yuma International	Yuma	50,300
Flagstaff Pulliam	Flagstaff	33,400
Lake Havasu City	Lake Havasu City	8,600
Sierra Vista	Sierra Vista	6,100
Earnest A. Love Field	Prescott	4,700
Show Low Municipal	Show Low	2,900
Page Municipal	Page	2,100
Kingman	Kingman	1,700
Total		**19,981,500**

Source: Arizona Department of Transportation, 2002.

Between 1999 and 2000, passenger enplanements in Arizona rose overall. Though many major airports saw only modest increases over that period (enplanements at Denver International Airport increased by less than two percent, for example), Sky Harbor saw nearly an eight percent rise.

Commercial and general aviation enplanements were estimated and forecasted using a combination of the *2000 Arizona State Aviation Needs Study* and Federal Aviation Administration adjustments for the September 11th, 2001 terrorist attacks. Table 7.6 presents 2002 estimates and 2025 forecasts of daily commercial and general aviation air passenger enplanement forecasts by county.

ADOT's Role in Aviation

ADOT owns a single airport, the Grand Canyon Airport. ADOT also has a separate division – Aeronautics – which is responsible for planning activities related to aviation. ADOT maintains an Aviation Fund that includes revenues from excise taxes on airplane fuel, aircraft license and registration fees, and other fees collected by the Aeronautics Division. This fund is dedicated to a variety of aviation projects across the State. The Aeronautics Division develops the State Aviation Plan, a parallel but independent process to MoveAZ. The State Aviation Plan identifies long-range aviation needs and planning in the State.

Table 7.6 Estimated Daily Commercial Enplanements and General Aviation Operations by County

	Commercial Enplanements		General Aviation Operations	
County	**2002**	**2025**	**2002**	**2025**
Apache			74	96
Cochise	23	51	310	366
Coconino	876	1,916	742	999
Gila			239	262
Graham	0	12	42	54
Greenlee			21	21
La Paz			39	49
Maricopa	41,717	91,191	5,212	8,089
Mohave	126	275	403	595
Navajo	5	22	220	267
Pima	4,660	10,186	1,217	1,581
Pinal			322	402
Santa Cruz			64	118
Yavapai	20	44	1,179	1,739
Yuma	165	361	109	145
Total	**47,592**	**104,058**	**10,193**	**14,783**

Source: Arizona Statewide Aviation Needs Study, 2000 and Cambridge Systematics, Inc., 2003.

7.5 Bicycle and Pedestrian

Extent

As shown in Figure 7.9 and Table 7.7, over 3,000 miles of the Arizona state highway network – including interstates, U.S. routes, and state routes – are considered suitable for bicycle traffic. Bike suitability is a function of traffic congestion, roadway speed limit, shoulder width, and truck volumes. Using standards identified in the Arizona Bicycle/ Pedestrian Plan recently completed by ADOT, nearly 60 percent of the state systems is of medium or high suitability. Individual metropolitan areas, such as Tucson, Phoenix, and Flagstaff, have their own bicycle networks as well. These networks include off-street

paths and trails, on-street bikeways delineated by painted white lines, signed on-street bike routes, and paved shoulders that can accommodate bicycles.

Figure 7.9 Bicycle Network in Arizona

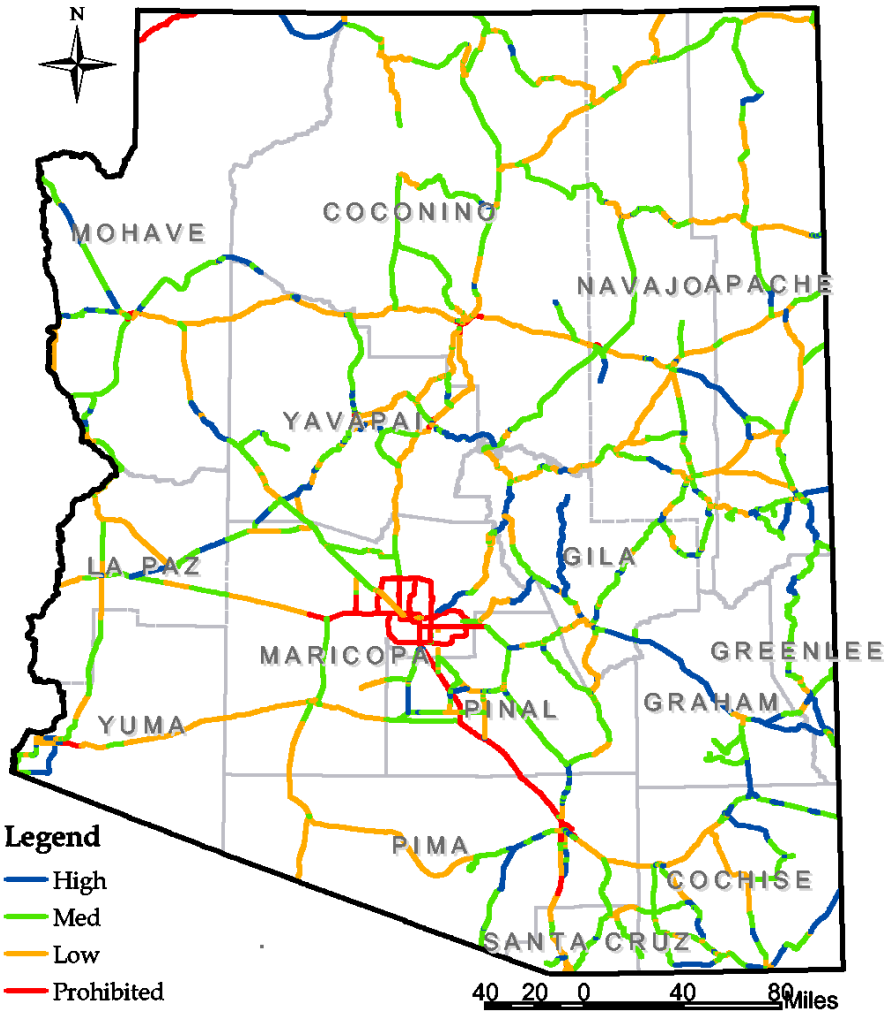


Table 7.7 Bicycle Suitability on the State Highway Network

Category	Percent Suitable
High	15%
Med	43%
Low	34%
Unsuitable	7%

Nearly every trip made in the State has a pedestrian component. Though these are often short trips from parking spaces to final destination, providing for safe pedestrian traffic is clearly an important function of the transportation system. Except for some undivided highways, the state highway system is generally not intended for pedestrian traffic. Some of the highest pedestrian flows on state-owned facilities are at the ports of entry between Arizona and Mexico. As shown in Table 7.8, a total of 8.4 million people crossed the border on foot in 1999, with the heaviest volumes at Nogales and San Luis.

Table 7.8 Arizona-Sonora Pedestrian Border Crossings, 2000

Port of Entry	Pedestrians Entering Arizona
Douglas	705,000
Lukeville	78,600
Naco	64,700
Nogales	4,806,100
Sasabe	3,600
San Luis	2,721,600
Total	**8,379,600**

Source: Bureau of Transportation Statistics.

Regional and local governments across the State have examined pedestrian issues as part of their planning efforts. At the regional level, MAG has developed a pedestrian plan for the Phoenix region that identifies locations for pedestrian-friendly roadway design, based on the level of expected pedestrian activity in that area, the desired pedestrian level of service, and operational and design characteristics of roadways. The Tucson metropolitan area has shared-use paths, as well as sidewalks along most streets. Existing Tucson standards require four-foot wide sidewalks in residential developments and up to eight-foot wide sidewalks for commercial and industrial developments.

Bicycle and Pedestrian Demand

Pedestrian and bicycle trips were estimated using data from the National Personal Transportation Survey, the Census Journey to Work, the FHWA, and the Bureau of Transportation Statistics. These estimates are for trips where the pedestrian portion or bicycle portion was the primary mode of travel for the trip. However, most trips include a pedestrian component, even when the primary mode of travel is the automobile. Table 7.9 presents estimates and forecasts of daily bicycle and pedestrian utilization by county for 2002 and 2025.

Table 7.9 Estimated Daily Bicycle and Pedestrian Trips, 2002 and 2025

	Bicycle Trips		Pedestrian Trips	
County	**2002**	**2025**	**2002**	**2025**
Apache	377	634	26,431	44,477
Cochise	3,991	6,401	35,580	57,063
Coconino	11,534	19,876	82,392	141,988
Gila	771	1,133	9,906	14,570
Graham	395	559	6,399	9,054
Greenlee	26	32	1,370	1,690
La Paz	729	1,227	7,626	12,836
Maricopa	200,779	331,412	498,001	822,014
Mohave	3,618	6,610	26,669	48,716
Navajo	288	479	9,161	15,209
Pima	72,656	106,416	164,007	240,215
Pinal	3,664	6,733	26,673	49,010
Santa Cruz	305	469	8,209	12,651
Yavapai	4,497	8,172	39,717	72,181
Yuma	6,715	10,947	34,261	55,859
Total	**310,345**	**501,100**	**976,402**	**1,597,533**

Note: Trips represent all purposes, but reflect primarily recreational trip making.
Source: Cambridge Systematics, Inc., 2003.

ADOT's Role in Bicycle and Pedestrian Travel

Though ADOT does not provide specific facilities for cyclists or pedestrians on state highways, many of the improvements that ADOT makes can benefit these road users as well. For example, wider shoulders on state routes in small towns and rural areas provide a location for bicyclists to commute and recreate safely. Where state routes pass through towns and function as both a through highway and a local road, design standards require ADOT to develop facilities, such as sidewalks, that benefit pedestrians.

ADOT also supports bicycle and pedestrian travel through planning studies. The Transportation Planning Division of ADOT recently completed a state bicycle and pedestrian plan. One result of this plan was a measure of bicycle suitability that was adopted by MoveAZ as the bicycle suitability performance measure. ADOT can also participate in

the design and construction of transit passenger facilities, including pull outs and shelters on state routes that benefit both pedestrians and bicyclists.

7.6 Summary

This chapter presented an overview of transportation modes in Arizona. Each of these modes is an important component of the overall transportation system in Arizona, and ADOT has significant and varied roles to play in the development and operation of each mode. Chapter 8 provides additional information on the transport of freight on these modes.

Several appendices provide additional detail regarding transportation modes in Arizona. Appendix A, the *Phase I Summary Report*, provides general background information on the extent of each mode of travel. This information was developed in 2002, and was updated for this Chapter. Appendix F, the *Demand and System Performance Analysis Technical Memorandum*, provides information on the demand for travel and the utilization of each of the modes. Appendix J, the *Goods Movement in Arizona Technical Memorandum*, provides additional detail regarding the freight system.

8. Goods Movement

Chapter 8. Goods Movement

This chapter presents information on four modes of goods movement in Arizona: truck, rail, air, and pipeline. The chapter provides an overview of the goods movement system and identifies the key links between goods movement and the Arizona economy. Appendix J, the *Goods Movement in Arizona Technical Memorandum*, provides additional detail regarding freight transportation.

8.1 Goods Movement System

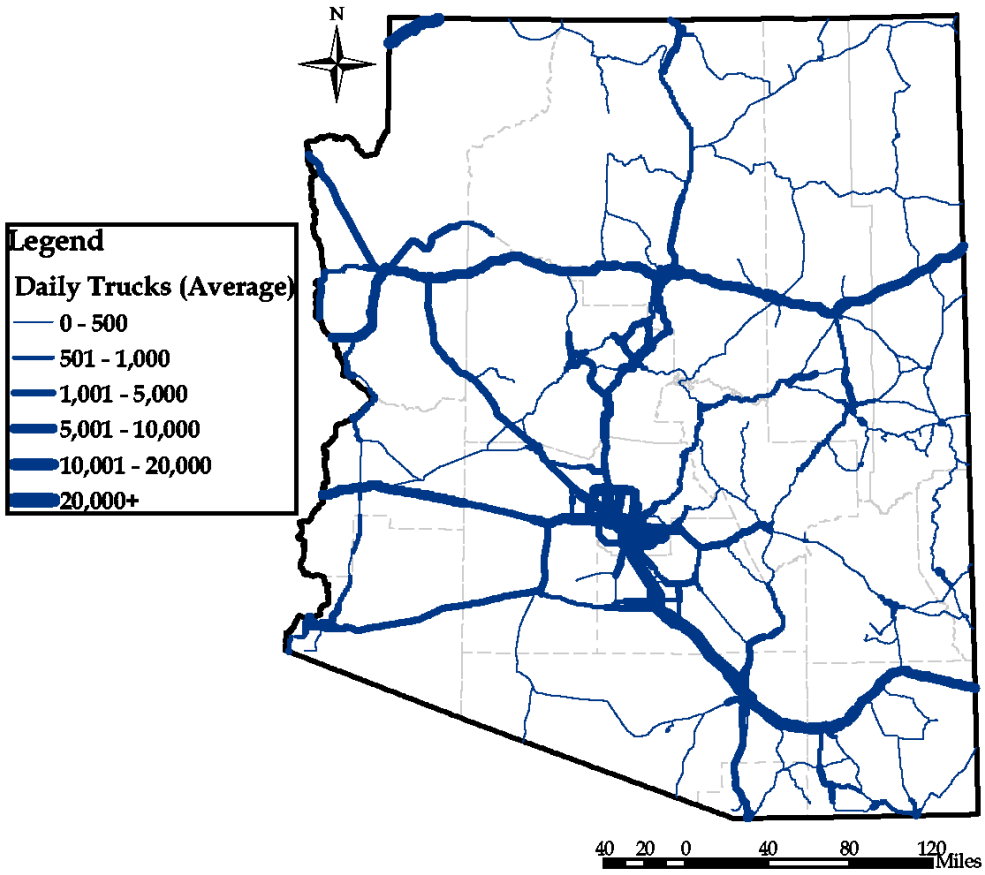
The freight transportation system in Arizona includes commodity movements by truck, rail, air, and pipeline. Major individual components on the freight system include interstates and major U.S. and state routes, the BNSF and UP railroads, and Phoenix and Tucson International Airports. This section describes each of the components of the goods movement system, including highways, rail, airports, pipeline, and intermodal facilities to transfer goods between modes.

Highways

The freight highway system includes interstates, U.S. routes, and selected state routes. Local truck routes are also an important part of the freight system, providing access to collection and distribution points. Freight-hauling trucks account for about 12 percent of total VMT in Arizona. The highest truck volumes are found on the interstate system, particularly along a 100-mile stretch of I-10 between Phoenix and Tucson. Figure 8.1 shows daily truck volumes on Arizona's state highway system. As Arizona's economy changes, truck volumes on the state highway system are expected to grow from nearly 15 million miles per day to over 33 million miles per day (Table 8.1). Trucks traffic is expected to grow faster than automobile traffic over this period, increasing from 19 to 23 percent of total traffic on the state highway system.

Arizona has identified several key freight traffic routes, including the CANAMEX Corridor, a major corridor initiative to link Canada to Mexico through Arizona, Nevada, Utah, Idaho, and Montana. In Arizona, the CANAMEX Corridor route operates on I-19, I-10, and U.S. 93, with a bypass of the Phoenix metro area along I-8 and SR 85. Two segments of this corridor – I-10 from Tucson to Phoenix and U.S. 93 – have been designated by the Arizona Transportation Board as high-priority corridors for the State. Another major freight corridor in Arizona is the I-10 Coast-to-Coast Corridor from California to Florida.

Figure 8.1 Average Daily Truck Traffic on Arizona Highways in 2002



Source: Arizona Department of Transportation, Highway Performance Monitoring System, 2002.

Table 8.1 Estimated Daily Truck VMT, 2002 and 2025

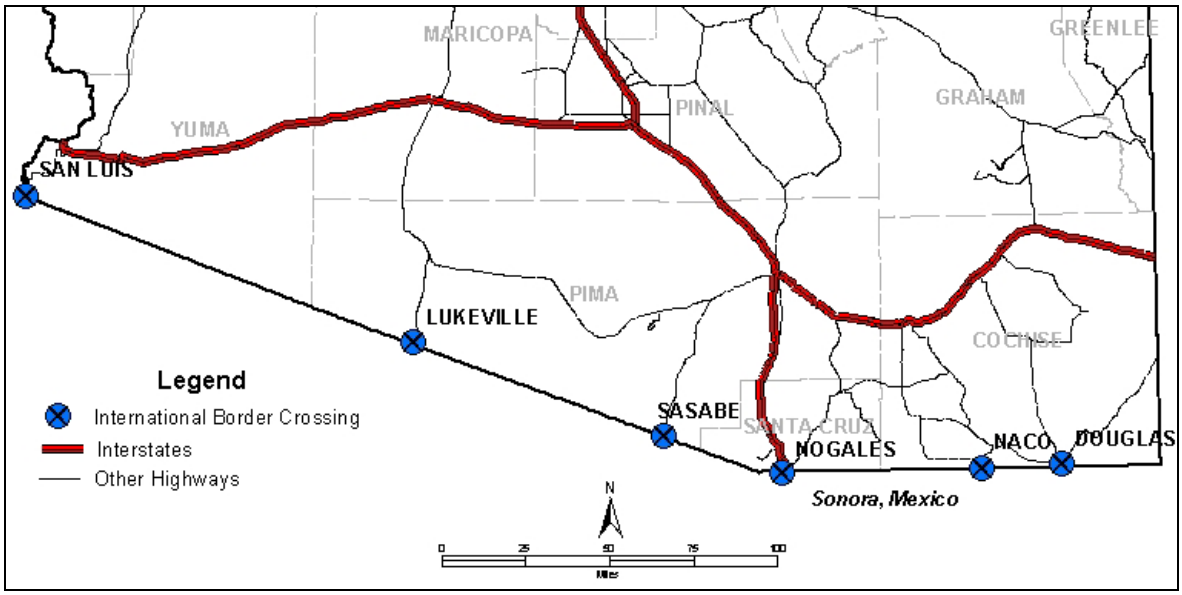
	2002	2025
Total VMT (State System)	77,879,600	142,551,400
Truck VMT (State System)	14,518,800	33,376,900
Truck Percentage of Total VMT	**19%**	**23%**

Source: Cambridge Systematics, Inc., 2003

Six ports of entry provide truck access between Arizona and Mexico: Douglas, Naco, Nogales, Sasabe, Lukeville, and San Luis (Figure 8.2). The Port of Nogales enjoys the most convenient highway access, with I-19 and SR 82 on the Arizona side and Mexican Federal

Highway 15 on the Sonora side. San Luis is served by U.S. 95 in Arizona and Mexican Federal Highway 2 in Sonora. Douglas is served by U.S. 191, SR 80, and Mexican Federal Highway 2. The remaining border crossings are served by undivided state highways, except for Naco, which is served only by local roads.

Figure 8.2 Arizona International Ports of Entry



Rail

As described in Chapter 7, Arizona's freight rail network consists of approximately 2,700 miles of track, including mainline, spurs, and yards. Freight and intercity passenger rail service share the same track in Arizona, but most of the tracks are owned and maintained by the UP and BNSF railroads.

Important segments of Arizona's rail network serve international freight traffic between Arizona and Mexico. UP's Nogales Branch, which runs between Tucson and Nogales parallel to I-19, connects with Grupo Ferroviaria Mexicana (GFM) at the Arizona-Mexico border. GFM operates a north-south line linking Nogales with Hermosillo, and ultimately Mexico City. Shipments through Nogales include double-stack containers of automobile parts bound for the Ford/Mazda assembly plant in Hermosillo, and assembled automobiles from Hermosillo bound for the U.S.

Aviation

Of the 83 public-use airports in Arizona, Phoenix Sky Harbor and Tucson International Airports are the primary facilities used to transport air cargo. Sky Harbor International is the largest airport in the Phoenix/Mesa metropolitan area that maintains active schedules for inbound and outbound air freight. Sky Harbor provides nearly 200,000 square feet of space and over 100 air cargo bays for air cargo services.

Air cargo operations at Williams Gateway Airport include specialized services and unscheduled charter flights. To meet the growing demands of the east valley of metropolitan Phoenix and to relieve pressure at Sky Harbor, cargo service improvements are planned at Williams Gateway Airport. These include dedicated air cargo facilities, a cargo ramp, additional warehousing facilities, and a runway extension to accommodate air cargo aircraft. Table 8.2 shows the freight cargo volumes at Arizona airports for 2000.

Table 8.2 Cargo and Passenger Volumes at Arizona Airports, 2000

Airport	City	Cargo Gross Landed Weight (Tons)
Phoenix Sky Harbor International	Phoenix	920,400
Tucson International	Tucson	142,400
Total		**1,062,800**

Source: Federal Aviation Administration, 2000.

Pipeline

Pipelines provide an important conduit for energy resources in the State. Though pipelines provide transportation exclusively for selected commodities, they have an impact on other modes by reducing long-distance truck or rail trips for natural gas, petroleum, gasoline, and other petroleum-based products.

Arizona imports all of the petroleum products and natural gas used in the State. In 2002, nearly 126,000 barrels of refined petroleum products were imported from California refineries each day. Roughly one-half of this is gasoline, with the other one-half splits between jet fuel and diesel fuel. An additional 87,000 barrels of refined petroleum products were imported from El Paso and Gulf Coast refineries, of which over 85 percent were gasoline. The transportation sector uses almost 88 percent of petroleum products, compared to 66 percent nationally. Arizona uses almost no petroleum-based heating fuels.

Natural gas in Arizona is provided by 11 separate companies serving 900,000 customers. Three pipelines transmit natural gas around and through the State. Two pipelines

provide service in the north of the State, with service to Window Rock, Flagstaff, Kingman, and into California. A third pipeline provides service in the south through Willcox, Tucson, Casa Grande, Ehrenberg, and into California, with extensions to Nogales, Safford, Globe, Phoenix, and Yuma. All natural gas flows originate outside of the State and enter Arizona from New Mexico. Through service is also provided to California, Nevada, and Mexico on Arizona's natural gas pipelines. Arizona currently lacks major natural gas storage facilities, though several are being explored by private interest. Storage helps balance loads, avoiding shortages and price spikes in times of high demand.

In recent years, pipeline capacity has become an issue both for petroleum-based products and natural gas. In the summer of 2003, a pipeline rupture in the Phoenix region created supply issues and caused a rapid escalation of gasoline prices. Similarly, a lack of pipeline capacity through Arizona and other Western states contributed to California's natural gas shortage and power crisis of 2000 to 2001.

Intermodal Facilities

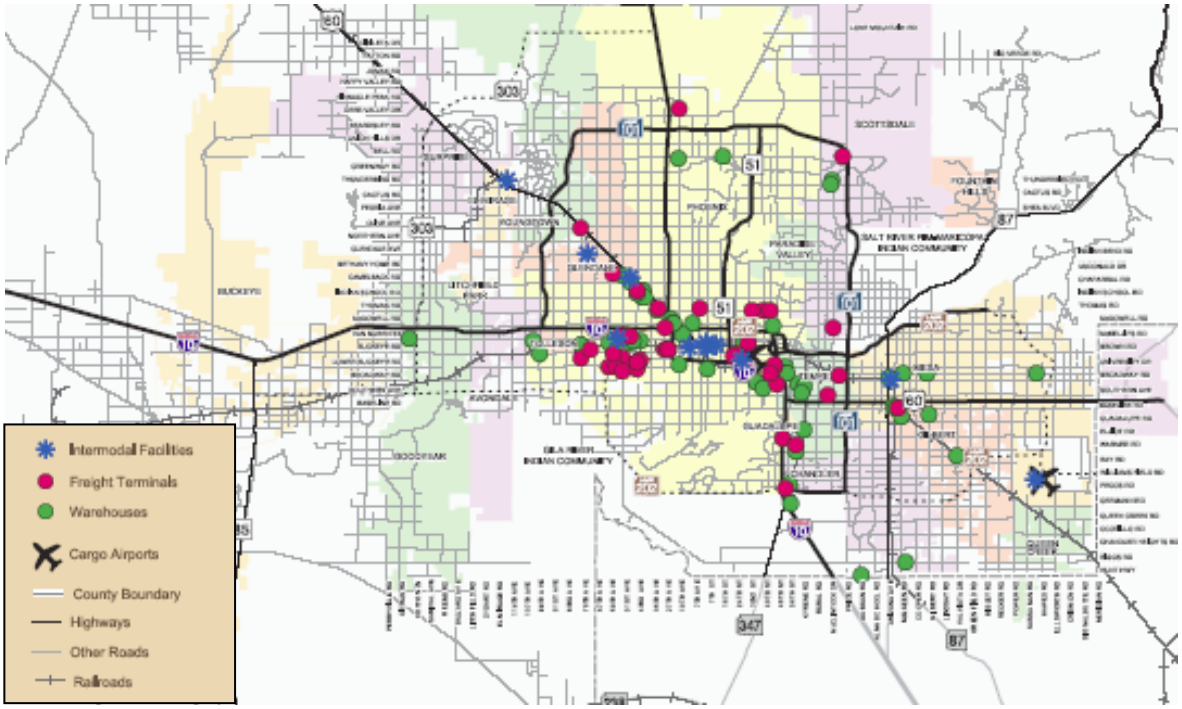
Intermodal facilities, such as airports, seaports, and train stations, provide transfer points and coordinate movements between various modes. There are 10 major freight highway-rail intermodal facilities in Arizona. Three are container cargo facilities, three are auto vehicle transfer points, three accommodate transfer of chemicals and chemical products, and one transfers liquid edibles. Seven of the facilities are located in the Phoenix metropolitan area, one is located in Parker, and two are located in Tucson.

MAG has worked extensively to document the freight infrastructure in the Phoenix metropolitan area, including intermodal facilities, freight terminals, and warehouses. Figure 8.3 shows that the majority of the freight-related facilities are located along the I-10 corridor, with another concentration of facilities along State Highway 60 northwest and east of downtown.

8.2 Goods Movement and the Domestic Economy

Goods movement is a critical part of the Arizona and national economy, both in terms of output and employment. Based on the most recent (1997) U.S. Economic Census, the percentage of output in the goods-related sectors of the economy was nearly three-fourths of the output of the entire economy in Arizona (Table 8.3). The largest goods-related sectors are wholesale trade, retail trade, and manufacturing. These three sectors combined to account for over 60 percent of sales in 1997. Overall, the goods-related sector accounts for two-thirds of sales and 42 percent of total employment in the State.

Figure 8.3 Phoenix Region Freight Infrastructure



Source: Adapted from Maricopa Association of Governments Regional Transportation Plan, 2003.

Table 8.3 Economic Output and Employment by Sector for Arizona in 1997

Sector	Arizona Sales ($1,000)	Percent of Total		Arizona Employees	Percent of Total	
		AZ	U.S.		AZ	U.S.
Wholesale trade	45,899,000	21%	23%	80,000	5%	6%
Retail trade	43,961,000	20%	14%	232,000	14%	14%
Manufacturing	43,030,000	20%	22%	194,000	12%	17%
Construction	19,115,000	9%	5%	132,000	8%	6%
Transportation, warehousing	4,086,000	2%	2%	45,000	3%	3%
Mining	3,069,000	1%	1%	13,000	1%	1%
All goods-related sectors	159,161,000	74%	66%	696,000	42%	45%
All services	56,121,000	26%	34%	945,000	58%	55%
All sectors	**215,282,000**	**100%**	**100%**	**1,641,000**	**100%**	**100%**

Source: U.S. Bureau of the Census, U.S. Economic Census, 1997

Goods Produced in Arizona

The FHWA created the Freight Analysis Framework (FAF) database to provide goods movement data by commodity and origin-destination pair at the state level. The top commodities, in terms of tonnage moved in Arizona, are shown in Table 8.4. The top four commodities represent 72 percent of the total tonnage produced in the State.

Table 8.4 High-Tonnage Commodities Produced in Arizona, 1998

Commodity	Internal	Outbound	Total (Produced in AZ)	Percent of Total
Clay, concrete, glass products	21,901,000	1,418,000	**23,319,000**	**19%**
Petroleum or coal products	21,114,000	2,055,000	**23,169,000**	**19%**
Nonmetallic minerals	22,976,000	69,000	**23,045,000**	**19%**
Secondary flows	15,486,000	2,280,000	**17,765,000**	**15%**
Food products	2,776,000	3,924,000	**6,700,000**	**6%**
Farm products	3,823,000	2,610,000	**6,433,000**	**5%**
Other commodities	7,780,000	13,278,000	**21,058,000**	**17%**
All commodities	**95,856,000**	**25,634,000**	**121,490,000**	**100%**

Source: Federal Highway Administration, Freight Analysis Framework, 1998.

Another way to examine the importance of particular commodities to Arizona is to examine the value of goods shipped. Though high-tonnage commodities have a disproportionate impact on the state transportation system, high-value commodities tend to add the most to the State's economy. The most recent data on the value of goods shipped comes from the 1997 Bureau of Transportation Statistics' Commodity Flow Survey (CFS). Table 8.5 shows the value of major commodities originating in Arizona, including shipments with destinations in Arizona. The electronics industry ships over 30 percent of the total value of goods shipped in Arizona. The five next largest commodities constitute 26 percent of the total value of goods shipped.

Table 8.5 Value of Arizona Shipments by Commodity, 1997

Commodity	Value ($ mil)	Value %
Electronics, electrical equipment, office equipment	27,600	32%
Base metal in primary or semi-finished forms	4,700	6%
Miscellaneous manufactured products	4,400	5%
Motorized and other vehicles (including parts)	4,300	5%
Transportation equipment, not elsewhere classified	4,100	5%
Other prepared foodstuffs and fats and oils	4,000	5%
Machinery	3,800	4%
Other commodities	33,300	39%
All commodities	**86,300**	**100%**

Source: Bureau of Transportation Statistics, Commodity Flow Survey, 1997.

Direction and Mode of Goods Movement

Arizona is a net importer of goods. Table 8.6 shows that the tons shipped into the State are nearly twice that of the tons shipped out of State. This indicates that Arizona's domestic goods movement is focused on end consumption by the growing population. Over one-half of Arizona's total tonnage is shipped internally within the State. Looking to 2020, the overall tonnage shipped into, out of, and within Arizona is forecast to increase by 87 percent. Outbound commodity flows show the largest increase of all trip types, but Arizona will remain a net importer of goods (more inbound flows than outbound). Internal trips will continue to dominate the directional flow of goods.

Table 8.6 Forecast of Tons Shipped by Trip Type, 1998 and 2020

Trip Type	Thousand Tons (1998)	Thousand Tons (2020)	Percent Growth (1998-2020)
Internal	95,800	213,200	122%
Outbound	25,600	59,800	133%
Inbound	47,900	84,000	75%
Total	**169,500**	**357,000**	**111%**

Source: Federal Highway Administration Freight Analysis Framework, 1998.

The majority of goods in Arizona currently move by truck, and that trend is expected to be sustained into the future. Of commodities that originate or terminate in Arizona, approximately 143 million tons were shipped by truck (Table 8.7) – a considerable strain on the highway network. This total is expected to grow by 120 percent from 1998 to 2020, with over 300 million tons shipped by truck in 2020. Air freight is expected to be the fastest growing mode for goods movement in Arizona between 1998 and 20202. In 2020, however, air freight will still transport less than one percent (by tonnage) of all goods moved.

Table 8.7 Total Tons Moved by Mode, 1998 and 2020

Transportation Mode	Thousand Tons (1998)	Thousand Tons (2020)	Percent Growth (1998-2020)
Highway	143,200	314,700	120%
Rail	25,800	41,000	59%
Air	400	1,360	240%
Total	**169,500**	**357,000**	**111%**

Source: Federal Highway Administration Freight Analysis Framework, 1998.

8.3 Goods Movement and the International Economy

In 2002, Arizona exported $11.9 billion worth of goods (Table 8.8). This is a significant quantity, relative to the $86 billion of domestic goods originating in Arizona in 1997. Arizona's largest export commodity is electrical machinery, accounting for over one-third of the total exports. Mexico is the largest single export country for Arizona, with $3 billion of goods received. However, the shipments to all Asian countries exceeded the value of shipments to Mexico, with $3.9 billon of goods received from Arizona. Access to port facilities in Southern California is crucial to the Asian export market and, thus, to Arizona's economy.

Trade between the United States and Mexico is an integral part of both countries' economies, particularly since the signing of NAFTA in 1993. Over 348,000 trucks crossed the U.S.-Mexican border into Arizona in 1999, carrying 242,000 loaded containers of freight. Nearly three-quarters of these trucks passed through Nogales (Table 8.9). This volume of trucks marks a 50 percent increase over the Sonora-Arizona traffic reported in 1991 to 1992.

Table 8.8 Destinations for Arizona's Exports in 2002

Region	Exports (Millions of Dollars)	Percent of Total
Asia (top 9 countries only)	3,900	33%
Mexico	3,000	26%
Europe (top 4 countries only)	2,100	18%
Canada	1,200	10%
Total (top 15 countries)	*10,200*	*86%*
Other	1,600	14%
Arizona Total	**11,900**	**100%**

Source: U.S. Census Bureau, Foreign Trade Division, 2002.

Much of the Arizona-Mexico border trade is related to the Maquiladora activity in the Sonora region of Mexico. The term Maquiladora refers to a manufacturing or processing firm that assembles component parts in Mexico that are temporarily imported from other countries, and returned to the origin country for final processing and sale. Maquiladora inputs include components, parts, and packaging materials used in the assembly or manufacturing process. As shown in Table 8.10, total inputs in 1997 for all of Mexico from all home countries were valued at $36.4 billion, with 97 percent of all inputs imported. The industry mix of the Maquiladoras is similar to the industry mix in Arizona, including the electronics industry and transportation equipment.

Table 8.9 Arizona-Sonora Vehicle, Passenger, and Freight Border Crossings

Port of Entry	Personal Vehicles	Personal Vehicle Passengers	Buses	Bus Passengers	Trucks	Loaded Freight Containers
Douglas, AZ	2,150,100	5,912,800	NA	3,700	32,600	14,700
Lukeville, AZ	501,300	1,373,700	500	17,800	4,300	500
Naco, AZ	326,600	849,300	NA	1,400	7,800	5,900
Nogales, AZ	4,187,000	10,489,100	5,800	34,500	256,400	200,400
Sasabe, AZ	34,900	90,800	NA	NA	2,400	900
San Luis, AZ	2,687,400	6,505,800	100	700	44,800	13,700
Total	**9,887,400**	**25,221,500**	**10,000**	**58,100**	**348,300**	**242,100**

Notes: NA = Not available. Numbers may not add to total due to rounding.
Source: Bureau of Transportation Statistics.

Table 8.10 Inputs for Maquiladoras, 1997 (in Millions of Dollars)

Industry	Total Inputs 1997	Imported Inputs 1997	Percent of Inputs That Are Imported
Electronics	13,700	13,500	99%
Transportation equipment	7,800	7,700	99%
Machinery and equipment	5,200	5,200	99%
Apparel	3,200	2,700	83%
Other manufacturing	3,100	3,000	98%
Wood and metal furniture	1,100	1,100	94%
Other	2,200	2,000	93%
Total	**36,400**	**35,300**	**97%**

Source: Arizona-Mexico Commission, 1999.

9. MoveAZ and the Five-Year Program

Chapter 9. MoveAZ and the Five-Year Program

The previous chapters of the MoveAZ plan discussed its three primary objectives: 1) to develop a strategic direction for transportation in the State of Arizona, 2) to coordinate with stakeholders and the public, and 3) to identify specific transportation projects for ADOT to deliver over the long term. This chapter addresses the transition from MoveAZ (planning) to ADOT's Priority Programming Process, the method used to identify specific transportation projects for funding in the *Five-Year Transportation Facilities Capital Program* (Five-Year Program). The chapter presents ADOT's existing programming process, as well as an updated process that incorporates MoveAZ.

9.1 Existing Priority Programming Process

The State Transportation Board has the authority to prioritize individual airport and highway projects in Arizona. Prioritization is accomplished through programming – the process of identifying individual transportation needs, defining projects to address those needs, and determining the order in which these projects receive funding. The Five-Year Program is the result of this process. It is updated each year to address changes in cost and scope to projects programmed in previous years and to add new projects into the fifth year of the program.

This section provides an overview of the programming process, including:

- The responsibilities of the Transportation Board, several committees, and ADOT in developing the Five-Year Program;
- Key project identification and funding differences between subprograms and major capital projects;
- The process of allocating resources to subprograms and projects and among regions of the State; and
- The process for programming major capital projects.

Key Committees and Responsibilities

The Transportation Board has ultimate responsibility for adopting the Five-Year Program. This is accomplished by working with ADOT and several advisory committees that help to identify the appropriate funding for projects across the State. The committees that help the Board develop the program include:

- **Priority Program Advisory Committee (PPAC) –** The PPAC consists of the State Engineer; the Deputy State Engineers in charge of Program Development, the Valley Transportation System, and Operations; and the ADOT Directors of Transportation Planning, Aeronautics, and Motor Vehicles. This group assists the Transportation Board in setting overall priorities for the program.

- **Technical Advisory Committee (TAC) –** The TAC includes representatives from ADOT's Transportation Planning and Intermodal Transportation Divisions, including district engineers. This group reviews and evaluates programming requests and recommends the priority program to the PPAC.

- **Project Review Board (PRB) –** The PRB is comprised of Development Group Managers from ADOT's Intermodal Transportation Division. This group addresses cost and schedule changes for projects under design.

- **Resource Allocation Advisory Committee (RAAC) –** The RAAC is comprised ADOT officials, Directors of MAG and PAG, Directors of two MPOs and/or councils of governments (COG), and Director of either the Regional Public Transit Association in Maricopa County or SunTran in Pima County. This group operates on a consensus decision-making basis to recommend how funding should be distributed among both the regions of the State and particular resource allocation categories (e.g., pavement preservation, safety, etc.).

Subprograms and Major Capital Projects

The programming process is designed to fund projects that will help ADOT meet its responsibilities to maintain and expand the transportation system in Arizona. These responsibilities include a wide variety of activities, such as repaving highways, providing funding to special needs transit operators, developing ADOT construction capabilities, and expanding capacity on the highway system. ADOT has identified three broad system categories that capture all of these activities:

1. **System preservation** includes projects that maintain the physical condition of the transportation system, such as pavement and bridge preservation;

2. **System management** includes funding for project and program development, such as scoping projects, testing materials, and conducting environmental reviews; and

3. **System improvements** include projects to address capital expansion of the transportation system, such as adding new lanes to existing highways, building new interchanges, and other similar projects.

Table 9.1 lists the key resource allocation categories within each of these three broad system categories. It also indicates which method is used to select and fund projects and activities.

Table 9.1 Program Resource Allocation Categories and Project Selection Method

System Category	Resource Allocation Category	Project Selection Method
System Preservation	• Bridge preservation	• Subprogram
	• Operational facilities	• Subprogram
	• Pavement preservation	• Subprogram
	• Public transit	• Subprogram
	• Roadside facilities	• Subprogram
	• Safety program	• Subprogram
System Management	• Development support	• Subprogram
	• Operating support program	• Subprogram
	• Operating contingency	• Subprogram
System Improvements	• Corridor improvements	• Major capital process
	• Major capacity/operational spot improvements	• Major capital process
	• Minor capacity/operational spot improvements	• District priorities
	• Roadside facilities improvements	• Subprogram

The process of selecting projects for inclusion in the Five-Year Program varies by resource allocation category. For many categories, a subprogram identifies the projects to be built in a given year. These subprograms typically use management systems to identify projects that help ADOT meet standards established by the Transportation Board. For example, the pavement preservation subprogram uses a pavement management system to determine the level of funding needed to maintain pavement quality at an acceptable level, and identify the highest priority projects in a given year. The Transportation Board allocates a pool of funding to each subprogram as a whole, based on an estimate of the total need for that subprogram. In general, most subprograms have identified greater needs than available funding. The State Transportation Board works with its advisory committees to set funding levels for each subprogram. Funding is then provided to

particular projects using management systems and other tools, as well as Transportation Board input, to select the projects that are most clearly needed in a given year.

Major capital projects go through a different, but complimentary process, described in more detail below. Because the subprograms use management systems that have their own performance measures or related evaluation methodologies to select projects, the MoveAZ plan, as well as this discussion of programming, focuses entirely on major capital projects. The remainder of this chapter is focused only on major capital projects. Subprograms are expected to use their existing processes to identify program projects.

Resource Allocation

Resource allocation is a combined process of financial forecasting and determining the distribution of these resources to major projects and subprograms and to major regions of the State. ADOT Financial Management Services (FMS) identifies the total funding available to the Five-Year Program (as well as the MoveAZ plan) from state and Federal sources. These estimates are based on projected receipts of fuel taxes, vehicle license fees, and other taxes and fees collected by Arizona and the Federal government. These estimates are updated at regular intervals to provide the most current and accurate assessment of available funding, as periodic economic changes can impact ADOT's ability to fund particular projects.

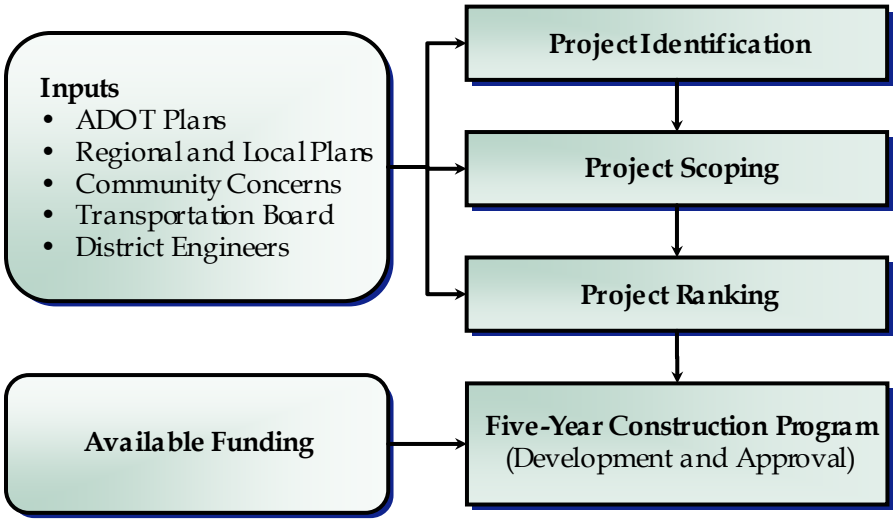
The RAAC provides guidance on allocating available funds among the regions of the State. For the last several years, the Transportation Board has divided funding among three regions of the State: Maricopa County, Pima County, and the 13 other counties. Maricopa receives 37 percent of the funding, Pima 13 percent, and the 13 other counties 50 percent.

In addition, funding is allocated to major projects and subprograms. The Transportation Board identifies funding levels for each subprogram as a whole, reserving funding each year to be programmed for major capital projects. As described in Chapter 6, the historical split between major capital projects and subprograms was used to estimate funding available to major capital projects over the course of the MoveAZ plan.

Programming Major Capital Projects

This section describes ADOT's process for identifying major capital projects and moving them through the programming process. This process is a joint effort of ADOT, MPOs, COGs, and the State Transportation Board. Though subprograms undergo a similar process, the discussion here is concerned exclusively with major capital projects. Figure 9.1 provides a graphic overview of the existing programming process. The steps of this process are described below.

Figure 9.1 ADOT'S Existing Priority Programming Process



Project identification – Project submittals come from several sources, including ADOT studies, regional, local, or tribal studies, district engineer recommendations, and community concerns. District engineers typically help identify major corridor and spot projects in their districts in consultation with local and regional officials and the public.

Project scoping – Once projects have been identified, a preliminary study (called a project scope) is conducted to estimate project need, potential impacts, preliminary design, and cost. Project scoping identifies whether a project requires more detailed environmental review or has fatal flaws that prevent it from being constructed. The scoping process ensures that a project meets the criteria of project readiness required by State statute (see Chapter 3 for additional detail). With hundreds of projects requested each year, the selection of projects to be scoped is the first stage of prioritization in the analysis of projects.

Project ranking – Once a scope is completed for a major project, it enters the pool of programmable projects. However, many more projects are identified each year than can be programmed in that year. The ranking process determines which projects ADOT will recommend to the Technical Advisory Committee and the Transportation Board for inclusion in the Five-Year Program. ADOT's Priority Programming Team recently implemented an updated project ranking methodology that compares projects on several quantitative and qualitative measures. Three overall measures are evaluated for each major project:

1. **Safety –** Number of crashes and the crash rate (crashes per million vehicle miles traveled) on the affected highway segments.

2. **Mobility –** Existing and future traffic volumes on the affected roadway segments and existing and future levels of service (LOS).

3. **Strategic/planning –** Project location on the National Highway System, Strategic Highway Network, and CANAMEX Corridor; system operating classification of the roadway; and functional class of the roadway.

Each major capital project that is considered for programming is scored on these three measures. After scoring and ranking the projects on the three measures, they are grouped into high, medium, and low priority lists of projects. These lists are used in the development of the program.

Program Development – The draft Five-Year Program is assembled from major projects and subprograms (see Table 9.1). The ranked pool of projects identified in the previous step is assembled into a Five-Year Program based on available resources and Transportation Board priorities. The first four years of the program are committed to projects identified in previous cycles, with new projects added to the fifth year of the program. At the programming stage, ADOT seeks to answer several questions that are not asked at the planning level, including:

- Is a project ready to be developed (i.e., project readiness)?
- Is there a local funding match for particular projects that might accelerate their delivery in the program?
- Are there operational constraints to delivering projects – such as a project already being developed in a corridor – that make it difficult to deliver a particular project?

The answers to these questions affect the specific projects that get included in the draft program. Using the lists described in the Project Ranking stage, the Technical Advisory Committee develops a recommended program. The Board reviews this program and makes changes to it using the same lists of projects identified in the project ranking stage. After the recommended program has been reviewed and refined by the Board, ADOT compares the program of projects against current budget estimates developed by ADOT Financial Management Systems. The recommended program is also reviewed by the State Engineers Office to ensure that the projects can be constructed in the timeframe outlined by the program. After all the reviews are completed, the Board adopts the draft program to be presented to the public.

Program approval – Public comments are gathered at public hearings held in Phoenix, Tucson, and Flagstaff. In addition, ADOT's consultation process with non-metropolitan, local-elected officials will be used to provide information about the programming process to these groups. Once public comments are incorporated, the State Transportation Board approves the final *Five-Year Transportation Construction Program*.

9.2 Integrating MoveAZ into the Five-Year Program

Integrating MoveAZ into the Priority Programming Process will occur over several programming cycles. Because ADOT is just beginning to undertake both performance-based planning and programming, it will take time to identify to implement a performance-based program. The purpose of this section is to outline that process.

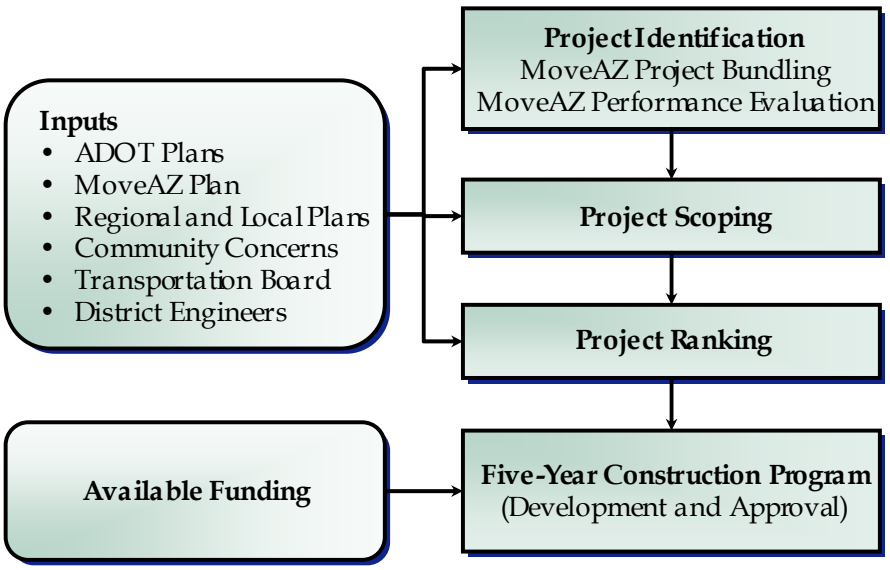
MoveAZ supports programming by providing quantitative information to ADOT to evaluate the performance benefits of major capital projects. MoveAZ does not supplant the current method used to develop the Five-Year Program or change the roles of ADOT staff and the Transportation Board. Instead, it provides additional project performance and benefit information to help support decision-making by these agencies.

This section describes two key aspects of the integration of MoveAZ into the programming process: 1) project identification and 2) scoping.

Project Identification

MoveAZ will interface with the programming process primarily at the project identification level. MoveAZ includes two key processes that affect the method of project identification. The relationship between these processes and MoveAZ are illustrated in Figure 9.2.

Figure 9.2 ADOT Updated Priority Programming Process



First, MoveAZ includes a process for examining the long-range impacts of projects. To do so, individual project elements were bundled into larger projects. This bundling process can be applied to needed improvements identified from any of a number of sources, including future planning studies, community concerns, projects identified by board members, and regional and local studies. As needs and projects are identified, they will be transmitted through this bundling process.

Second, MoveAZ includes a quantitative process for evaluating the performance impacts of these bundles. Each bundle that is identified for potential programming will pass through this process.

The result of these analyses will be a set of bundled projects scored and ranked according to performance measures for consideration in the programming process. Project bundles will then be considered for scoping.

Scoping

Before project identification transitions completely to the MoveAZ process, ADOT will need to clear the pipeline of already-scoped projects. The existing scoping pool includes hundreds of millions of dollars of projects. Some of these projects will have fatal flaws or other considerations that prevent them from being programmed. Due to the sheer volume of projects already scoped, ADOT will need multiple programming cycles to work through these previously scoped projects before the project bundling and evaluation process developed for MoveAZ is used for all projects.

ADOT has limited funding to pay for scoping studies. In 2003, only two new scoping studies were completed at a cost of close to $1 million each. With additional projects under consideration from the MoveAZ process, additional funding will be necessary to be able to scope all of these projects. As described above, selecting projects for scoping is the first stage in the project prioritization process. ADOT, the Transportation Board, and its committees will use the performance analysis from MoveAZ and other information to identify projects that are first in line for scoping.

■ 9.3 Next Steps

The approaches presented above highlight how ADOT's priority programming process will utilize the performance evaluations developed for MoveAZ. The process of capital programming is based not only on technical evaluation, but also using a variety of policy considerations and qualitative factors, such as timing and funding. The next step is to apply and continually refine the methodology to integrate MoveAZ project bundles into future programming cycles.

MoveAZ used a number of important inputs to identify projects and evaluate them. Over the next several years, ADOT will continue to update and refine these inputs, including:

- Conducting new multimodal regional transportation profiles all across the State. Figure 9.4 presents the approach ADOT will take to conduct these profiles in the future. The profiles will cover large geographic regions of the State than the corridor profiles ADOT has conducted over the past 10 years, and will provide information about the state highway system within the area. The transportation profiles will be the primary source of needs assessment and project identification for planning.

- Continue developing Small Area Transportation Studies (SATS) in small towns and communities across the State. SATS are another means to identify potential projects for evaluation and consideration.

- Updating the State Bicycle/Pedestrian Plan, building on the plan that was completed in 2003.

- Conducting a freight and goods movement study. This study will focus on the economic impacts of goods movement and the infrastructure critical to support the freight system.

- Conducting regional transit plans for each of the four COGs in Arizona (Northern, Western, Central, and Southeastern).

These inputs, as well as studies conducted by regional planning agencies, will be used to identify deficiencies on the state transportation system, suggest projects to improve transportation, and be evaluated in the updated long-range transportation plan every five years, as required by state law. The process to develop an updated plan will build on the work completed for MoveAZ, advancing ADOT's use of performance-based planning and programming.

Figure 9.3 Regional Corridor Study Areas